Jl S. Afr. Bot. 35 (5): 267–320 (1969)

STUDIES IN THE XYLARIACEAE:

VI. *DALDINIA*, *NUMULARIOLA* AND THEIR ALLIES

P. MARTIN

(*Department of Microbiology, South African Institute for Medical Research, Johannesburg.*)

INTRODUCTION

The genera of the Xylariaceae, excluding *Xylaria* and related series, which contain large stromata represent off shoots from *Hypoxylon* or possibly *Lopadostoma* in which there has been first the consistent production of several perithecia per stroma and second the development of one or more unusual features which separate them off rather sharply. Two series are recognizable: the first, comprising *Daldinia*, *Entonaema*, *Phylacia*, and *Thamnomyces*, is characterized by pigment in the stroma, and the predominance of basal tissue beneath the perithecia or development of a stipe; the second, comprising *Numulariola*, includes erumpent non pigmented forms that are often effused to a great extent.

Series I.

1. *Entonaema* Möller A. Phycomyceten und Ascomyceten p.p. 246, 306. In A. F. W. Schimper: Bot. Mitth. aus dem Tropen. IX, Gustav Fischer, Jena, (1901).

This genus, which has been reviewed by G. W. Martin (1938), comprises 4 species distinguished by large irregularly pulvinate to repand stromata in which the entostroma is gelatinous, forming a jelly which is persistent up to maturity and later dries out to leave hollow cavities. The entostroma becomes corky at the periphery and is covered by a conspicuous white or yellow ectostroma of similar texture. This would seem to relate it closest to the coloured members of Euhypoxylon. See Plate I: 1 and 2.

KEY TO THE SPECIES

1. Stromata substipitate; outer layer striate; spores $5 \times 10—11\mu$.
    Entonaema mesenterica Möller
1′. Stromata sessile; outer layer continuous...2

Accepted for publication 24th October, 1968.

2. Ectostroma reddish, partly evanescent at maturity; perithecia evident in outline; spores $6 \cdot 0 \times 12 \cdot 0\mu$*
   Entonaema cinnabarina (Cke. & Massee) Lloyd
2′. Ectrostroma yellow-orange; spores $5 \cdot 5$—$6 \cdot 5 \times 10 \cdot 0$—$12 \cdot 0\mu$
   Entonaema liquescens Möller
2″. Ectrostroma white to cream; spores $5 \cdot 0 \times 11 \cdot 0\mu$
   Entonaema pallida G. W. Martin

No material has yet been found to yield cultures.

2. *Daldinia* Cesati V. and G. De Notaris Scheme classif. Sferiacei Ital *1*, 197, (1863).

Daldinia as presently understood was erected by Cesati and De Notaris who were the first to recognize that the large size of the stroma and the predominance and zonation of the entostroma were much more pronounced than in the related genus *Hypoxlon*. It is questionable whether these characters are sufficient to erect a genus, but, taken together with the constant production of a large number of perithecia, the 13 species discussed later in detail by Child (1932) do form a distinct series. Wakefield (1940) and Rogers (1949) conserved the genus against earlier taxa: *Hemisphaeria* Klotzsch, *Perisphaeria* Rouss., *Peripherostroma* Gray and *Stromatosphaeria* Greville.

The ascal plugs are thin (Plate IV: 6) and the structure of the stroma differs in no essential respect from the larger aplanopulvinate or hemispheric members of Euhypoxylon (*H. sclerophaeum*, *H. mulleri*, & *H. fragiforme*), with brittle refractive vinaceous ectostroma and corky entostroma; but the entostroma is zonate due to the alternate formation of long effuse and short closely packed hyphae (Plate IV: 11). According to Miller (1928), the darker zones are formed by disintegration of the perithecial initials followed by continued (?perennial) growth beyond them to produce successive zones, the number of zones being limited by the time of formation of the perithecia. The writer has observed abortive perithecial initials along the penultimate zone in *D. concentrica* but has found no evidence that any such are present deeper in the stroma. The peculiar zonate development remains a mystery, more so since the writer has observed it to take place within one season, and thus cannot represent successive increments of growth over a long time. Spores in *Daldinia* are characteristically inequilateral elliptic and dark brown to black, and do not vary greatly from one species to another except as regards size (Plate IV: 10).

The following key is modified from Child (1932):—

1. Entostroma persistent, dense, not gelatinous; dark zones predominant, some shade of brown 2
1′. Entostroma persistent or collapsing, with persistent dark zonal lines, or else gelatinous in appearance; light zones predominant, white or some shade of grey 6

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* Decimal figures represent averages of at least 10 spores; integers mere range of dimension.

2. Stroma sessile or substipitate; stipe when present broad, exceeding 5 mm thick and not cylindric.

2′. Stroma definitely stipitate; stipe cylindrical, less than 5 mm thick, and supporting a globose to subglobose fertile head; spores 7·0 × 14·0μ.
Daldinia loculate (Lév.) Saccardo.

3. Ostioles umbilicate, not visible, or slightly raised; spores 5·5—7·0 × 12·0—13·5μ.
Daldinia eschscholzii (Ehrenb.) Rehm.

3′. Ostioles prominent, papillate to mammiform, stroma somewhat rough............4

4. Stromata usually large, irregular, always sessile; perithecia mostly polystichous. Spores 6·5—8·0 × 14·5—16·0μ.
Daldinia grande Child.

4′. Stromata otherwise, spores smaller..5

5. Mature stromata bronze-black, spores narrow ended, 6·0—9·0 × 12·5—16·5μ.
Daldinia occidentale Child.

5′. Mature stromata vinaceous black to dull black; spores broad ended, 5·5—8·5 × 11·00—14·5μ.
Daldinia concentrica (Bolt.) Ces. and DN.

6. (1) Entostroma dense, not collapsing at maturity...............................7

6′. Entostroma loose, collapsing or becoming gelatinous with hollow locules..........9

7. Ostioles prominent; spores 6·5 × 14·5μ.
Daldinia bakeri Lloyd.

7′. Ostioles umbilicate or not visible...8

8. Perithecia subspherical or short ovate; spores 4·5 × 8·5μ.
Daldinia gollani Hennings.

8′. Perithecia elongate ovate; spores 6·0 × 12·0μ.
Daldinia caldariorum Hennings.

9. (6) Stromata turbinate, regular or irregular..................................10

9′. Stromata clavate..12

10. Spores small, 3·0 × 8·0μ.
Daldinia albozonata Lloyd.

10′. Spores larger...11

11. Stromata hard, rigid and coal black inside; basal tissue amber yellow or dull white, gelatinous and loculate; spores 7·0 × 12·0μ.
Daldinia vernicosa (Schw.) Ces. and DN.

11′. Stromata dark brown, ectostroma fibrous; spores 6·5 × 11·0μ.
Daldinia simulans Child.

12. (9) Perithecia confined to the upper part of the cylindrical stroma; ostioles conspicuous; stipe externally zonate with annulate thickening; spores 5·0 × 9·5μ.
Daldinia cuprea Starbäck.

12′. Perithecia dispersed over entire stroma, not confined to the upper half; ostioles umbilicate or not visible; spores 5·0 × 9·5μ.
Daldinia clavata Henn.

1. **Daldinia concentrica** (Bolton) Ces. and DN. (Plate V: 8)

Allport D. C. and J. D. Bu'Lock J. Chem. Soc. **1960,** 654—662, (1960). Anderson J. M. and J. Murray Chem. and Ind. **1956,** 376, (1956). Berlése A. N. Fungi moricolae V, 8, (1889). Berlése A. N. and G. Bresadola Ann. Soc. Alp. Trid. **14,** 22, (1887—1888). Bizzozero G. Flora veneta critt. **1,** 201, (1885). Bresadola G. and P. A. Saccardo Malpighia **11,** 294, (1897). Cesati V. and G. De Notaris Schema class. Sferiacei Ital. 197, (1863). Chardon C. E. Bol. Réal Soc. Espana Hist. Nat. **28,** 121, (1928). Child M. Ann. Mo. Bot. Gard. **16,** 411—486, (1929); Ibid **19,** 446, (1932). Cooke M. C. Handbook of Australian Fungi, 292, (1892). Dennis R. W. G. British Cup Fungi 180, (1960). Ellis J. B. and B. M. Everhart Jour. Mycol. **4,** 111, (1888); N. Amer. Pyren., 660, (1892). Hennings P. Bot. Jahrb. **14,** 365, (1892); Hedwigia **32,** 225, (1893); Ofvers af Kongl. Vetenskap. förh. **2,** 328, (1900); Hedwigia **40,** 339, (1901); Ibid **42,** (82), (1903). Ibid 47, 259, (1908). Lindau G. Die mikroskopischen Pilze: Krypt. f. Anfänger **2,** (1), 134, (1897). Lloyd C. G., Myc. Writ. **5,** Large Pyren. II, 23, (1919). Miller J. H. Mycologia **20,** 328, (1928); Jour. Dept. Agric Puerto Rico **14,** 274, (1930); Trans. Brit. Mycol. Soc. **15,** 152, (1930); Monog. Univ. Puerto Rico B **2,** 198, (1934); Bothalia **4,** 252, (1942). Möller A. Phycomyceten und Ascomyceten, 264, (1901). Parks H. E. Univ. Calif. Bot. **12,** 50, (1926). Patouillard N. and A. Gaillard Bull.

Soc. Myc. de Fr. **4,** 110, (1888). Petch T. Ann. roy. bot. gard. Perad. **8,** 165, (1924). Rehm H. Hedwigia **40,** 143, (1901). Rick J. Brotéria ser. bot. **25,** 35, (1931). Saccardo P. A. Fungi Ital. 565, (1877—1886). Saccardo P. A. and A. N. Berlése Atti R. Instituto Ven. Sci. Lett. Art. **3,** 3, (1885). Spegazzini C. Anal. Soc. Cient. Arg. **12,** 152, (1881). Starbäck K. Bih. Svenska Vet-akad. Handl. **27,** (9), 5. (1901). Sydow H. and F. Petrak Ann. Mycol. **20,** 186, (1922). Sydow H. and E. J. Butler Ibid **9,** 417, (1911). Theissen F. Ann. Mycol. **7,** 3, (1909). Traverso J. B. Flora Ital. Crypt. **1,** 33, (1906). Viégas A. P. Bragantia **4,** 100, (1944).

sub *Hypoxylon concentricum* Greville.

Berkeley M. J. Ann. and Mag. Nat. Hist. **2,** 12, (1852); Jour. Linn. Soc. **10,** 383, (1869); Ibid. **13,** 177, (1873); Grevillea **4,** 48, (1875); Jour. Linn. Soc. **16,** 144, (1878). Berkeley M. J. and C. E. Broome Ibid **14,** 120, (1875); Trans. Linn. Soc. Lond. II **1,** 405, (1879). Cooke M. C. Handbook of British Fungi II, 794, (1871). Fries E. M. Nova acta reg. Soc. Scient. Upsala III, **1,** 114, (1851). Fuckel L. Symb. Myc. Nachtrag II, 43, (1873). Greville R. K. Scottish Crypt. Flora **6,** 324, (1828). Jaczewski A. L. Bull. Soc. Myc. de Fr. **11,** 115, (1895). Karsten P. A. Mycol. Fennica II: Pyr., **37,** (1873). Lambotte E. Flore Mycol. belge 424, (1880). Montagne J. F. C. in Sagra: Hist. Cuba, 340, (1838—1842); in Gay; Hist. Chile VII, 440, (1850). Nitschke T. Pyren. Germ. **1,** 25, (1867). Passerini G. Nuovo Giorn. Bot. Ital. **7,** 186, (1875). Quélet L. Champ. Jura and Vosges III 490, (1875). Rabenhorst L. Krypt flor. Deutsch II, 866, (1887).

sub *Peripherostroma concentrica* Gray

Gray S. F. Natural arrangement of British Plants I, 513, (1821).

sub *Sphaeria concentrica* Persoon

Albertini J. D. and L. D. de Schweinitz Conspectus fungorum, 3. (1805). Berkeley M. J. in Smith: English Flora **5,** (2), 236, (1836). Currey F. Trans. Linn. Soc. Lond. **22,** 265, (1859). Durieu de Maisonneuve M. and J. F. C. Montagne Eyplor. Alger. I, 451, (1846). Fries E. M. Syst. Mycol. 331, (1823); Elenchus fungorum II, 62, (1828). Hooker W. J. Flora Scotica II, 4, (1821). Junghuhn F. H. Praemissa Fl. Crypt. Javae **20,** (1838). Nees von Esenbeck C. System der Pilze und Schwämme 290, (1817). Persoon C. H. Comment Fung. Clav. 150, (1797); Syst. Meth. Fung. 8, (1801—1808).

sub *Sphaeria hemisphaerica* Nees.

Nees von Esenbeck C. Syst. der Pilze and Schwamme 308, (1817).

sub *Stromatosphaeria concentrica* Greville

Greville R. K. Flora edinensis 355, (1824).

Stromata pulvinate to sub-globose, 8·5—36 × 9·5—53 × 6·5—23 mm, bases embedded in bark or wood. Initial layer orange-brown or pink, changing to reddish brown, vinaceous or sepia at maturity, or remaining orange brown. Surface usually dull matt as in *Hypoxylon* but sometimes sodden, continuous or worn off at random, exposing the brittle refractive ectostroma. Ectostroma deep orange or vinaceous, black at sight but disintegrating into particles of the same colour in microscopic preparation. Entostroma massive, corky or woody, dull brown to black, usually solid, with a large number of alternating light and dark zones. Perithecia arise near the periphery, adjacent or close crowded, long ovate, 300—900 × 900—1,500μ; ostioles indistinct umbilicate though sometimes raised above the stromal level, or occasionally papillate. Asci cylindric, 140—220 × 6—11μ; stipes 67—135μ. Spores gibbous, navicular, or broad crescentic, rarely with narrow ends, brown, 5·5—9·5 × 10·0—16·5μ, ave. 6·8 × 12·4μ.

Material examined:—

A large quantity of material in the herbaria cited (Martin 1968, p. 156). Martin 509; Garden of Eden, Knysna, Western Cape, South Africa (1959). Martin 548, 550, 551; Hogsback nr Alice, Eastern Cape, South Africa, (1959). Martin 630 ex Chaves Batista; Belém, Brazil. Martin 1957; Stoneybrook, Rockland Co., NY State, U.S.A., (1963). Martin

1634—6, Nyack, NY State, U.S.A., (1963). Martin 1721, 1724; Savoy State Forest, Mass., U.S.A., (1963). Martin 1764 ex Carroll 176; Elsehored Fyn, Denmark, (1962).

Cultural characters (Plate VI: 1, 2. See also Martin (1967) p. 222, fig. 3):—

Colonies cottony, dry, growing free with a rather coarse texture, mycelium very dispersed. Mycelial aggregates slight to extensive in quantity, comprising chiefly secondary mycelium. Margin not distinct, hyphae widely dispersed. Aerial mycelium dull white, sometimes partly ochraceous or green as well. Conidia formed by 7 days or when old. Stain amber, dull buff-brown, or red-brown. Growth rapid, 6·0—8·6 mm/day at 25°C.

Microscopic characters: (Fig. I: 1; Plate VIII: 11):—

Primary mycelium undiagnostic; maximum diameter of marginal hyphae = 2·5μ. Secondary mycelium reticulate-tentacular, also with irregular globose swellings, 1·2—2·5μ diameter.

Imperfect stage (Plate VIII: 8—10):—

Brooks F. T. Trans. Brit. Mycol. Soc. **4,** 245, (1913). Elliott J. S. B. Ibid **6,** 269—273, (1920) (sub *Nodulisporium tulasnei* Molliard). Jaczewski A. L. Bull. Soc. Myc. de France **11,** 115, (1895) (sub *Hypoxylon*). Miller J. H. Mycologia **20,** 328, (1928). Molliard M. Bull. Soc. Myc. de France **20,** 55—60, (1904).

Conidiophores are only distinct from the vegetative mycelium when warted; colourless, variable in length, 27—450 × 1·8—3·1μ, unbranched to branched indefinitely, dichotomously or with 3—4 branches off the same node. Fertile branches narrow or swollen clavate lying freely or in trident formation, heads unspecialized or slightly swollen, 8·5—120 × 1·5—3·7μ. Conidia acrogenous, globose, oval, or sometimes narrow clavate or botuliform, white en masse, 3·7—5·0 × 4·3—8·7μ, ave. 4·1 × 6·3μ.

The descriptions in the literature approximate closer to the *Acrostaphylus* type of conidiophore observed by the writer for *D. eschscholzii* than to *D. concentrica* as cultured by the writer. The form of imperfect stage of *D. concentrica* varies from *Sporothrix* to a simple type of *Acrostaphylus* only.

2. **Daldinia occidentale** Child

Child M. Ann. Mo. Bot. Gard. **19,** 453, 1932.

Stromata pulvinate to hemispheric, 6·0—32 × 9—43 × 6·0—17μ, arising from a central point or from an ill-differentiated stipe up to 6·5 mm in diameter and 5 mm high. Surface of stromata smooth, reddish-brown; ectostroma brittle refractive, black at sight but yielding vinaceous particles in microscopic section, entostroma massive, dull brown to black, solid, with several zones of alternating light and dark colour, the latter predominant. Perithecia close crowded, evident at vertices to completely immersed, long ovate, 400—600 × 900—1500μ;

ostioles umbilicate, not visible or minutely papillate. Asci not seen. Spores elliptic, gibbous or navicular, narrow ended, dark brown, opaque, 5·0—10·0 × 10·5—20·0μ, ave. 6·8 × 13·6μ.

Material examined:—

Martin 680; culture ex CBS, Baarn. Martin 873, 874; Arcata, N. California, U.S.A. (1961). Martin 910, 936, 937, Mazatlàn, Sinaloa, Mexico (1961). Martin 984, 1542; San Blàs, Nayarit, Mexico, (1961, 1962). Parks 3927; on *Alnus rubra*, Humboldt Co., Trinidad, California, U.S.A., (1931), (NYBG). Zeller; on *Alnus*, Waldport, Ore., U.S.A., (1929), (NYBG).

Cultural characters:—

Colonies cottony, dry, dull white, growing freely with coarse texture; mycelial aggregates extensive. Margin not distinct, entire, hyphae compact, conidia developing by 7 days but not conspicuous. Stain red brown, amber or bottle green. Growth rapid, 6·0—6·7 mm/day at 25°C.

Microscopic characters:—

Primary mycelium undiagnostic; marginal hyphae with a maximum diameter of 2·5μ. Secondary mycelium uniform or with irregular globose swellings, loose or reticulate-tentacular, 1·2—7·5μ diam.

Conidiaphores and conidia (Plate VIII: 12, 13):—

Conidiophores hardly distinct from the vegetative mycelium, 30—360 × 1·2—2.5μ, unbranched to indefinitely branched dichotomously or ternately over the apices or upper parts of the main axes. Fertile branches narrow, lying freely or in trident formation, with unspecialized heads, 9·6—49 × 1·8—2·5μ. Conidia acrogenous, sessile or on stout sterigmata, long clavate to botuliform, white en masse, 1·2—3·1 × 4·3—7·5μ, ave. 2·4 × 5·4μ.

This species may only be a variant of *D. concentrica* but is distinguished by its slightly smaller stromata, absence of purple colouration, and the narrower conidia.

3. **Daldinia eschscholzii** (Ehr.) Rehm.

Baker C. F. Leafl. Philipp. Bot. **7,** 2485, (1914). Child M. Ann. Mo. Bot. Gard. **19,** 458, (1932). Ferdinandsen C. & O. Winge Bot. Tidskrif **29,** 13, (1909). Miller J. H. Bothalia IV, 252, (1942). Rehm H. Ann. Mycol. **2,** 175, (1904); Ibid **5,** 211, (1907); Leafl. Philipp. Bot. **6,** 2206, (1914); Ibid. **6,** 2273, (1914) Saccardo P. A. & A. N. Berlése Atti R. Inst. Ven. Sci. Lett. & Art. **3,** 3, (1885). Starbäck K. Arkiv. für Bot. **5,** 29, (1905).

sub *Daldinia concentrica* var *eschscholzii* Bres.
Bresadola G. Hedwigia **53,** 80, (1912).
sub *Daldinia concentrica* var *microspora* (Starb) Theiss.
Theissen F. Ann. Mycol. **7,** 3, (1909).
sub *Daldinia corrugata* Pat. & Har.
Patouillard N. and P. Hariot. Bull. Soc. Myc. de Fr. **22,** 120, (1906).
sub *Daldinia luzonensis* Rehm.
Rehm H. Philipp. J. Sci. **8,** 260, 1913.

Stromata globose to pulvinate or hemispheric, 5·0—38 × 8·0—45 × 5—23 mm. Surface red-purple or red-brown, ectostroma refractive, deep orange but dark at sight, yielding yellow-orange vinaceous particles in microscopic section. Entostroma massive, brown, with alternating light and dark zones, the former predominating. Perithecia immersed, long ovate, 400—700 × 1000—1500μ, close crowded; ostioles umbilicate sometimes raised above stroma level. Asci cylindric, 145—310 × 7—8μ; stipes 83—230μ. Spores elliptic equilateral or navicular, broad or narrow ended, dark brown to black, 5·0—7·5 × 11·0—16·5μ, ave. 6·3 × 12·7μ.

South African hosts: *Passerina falcifolia*. Mainly found in scrub or bush, not in heavy forest, unlike *D. concentrica*.

Material examined:—

Martin 419; Nature's Valley, Knysna District, Western Cape, South Africa (1958). Martin 642 ex Lowy; Baton Rouge, La., U.S.A., (1961). Martin 948; Mazatlàn, Sinaloa, Mexico (1961). Martin 1795 ex Carroll 175; University of Costa Rica, San Pedro, Costa Rica, (1962).

Cultural characters (Plate V: 7; Plate VI: 7):—

Colonies felty to cottony, dull white, much denser and more compact than those of *D. concentrica*, growing freely with coarse texture; mycelial aggregates extensive. Conidia formed immediately but not conspicuous. Stain red-orange to greenish-brown, in fleck formation or fairly uniform. Growth rate rapid, 8·7—10·5 mm/day at 25°C.

Microscopic characters:—

Primary mycelium undiagnostic; maximum diameter of marginal hyphae = 3·0μ. Secondary mycelium uniform, loose to reticulate-tentacular, 1·1—4·4μ diam.

Conidiophores and conidia (Fig. I: 7; Plate VIII: 1—3):—

Conidiophores sharply distinct from the vegetative mycelium, due to broader diameter, pitted walls and sometimes a reddish tint, 30—650 × 1·8—3·2μ, unbranched or branched up to the second degree over most or part of the main axes with 2—4 fertile branches arising at a node. Fertile branches narrow or more usually swollen clavate, lying free or in trident formation with slightly swollen or unspecialized heads; 8—40 × 1·8—4.0μ. Conidia acrogenous, acrogenous or in fascicles off the hyphae, sessile or borne on sterignata, thin-walled, clavate, narrow-based, white to pink en masse, 1·7—3·7 × 3·4—6·3μ, ave. 2·3 × 4·7μ.

The species in distinct from *D. concentrica* by its smaller stromata and *Acrotaphylus* type conidiophores.

4. **Daldinia bakeri** Lloyd.

Child M. Ann. Mo. Bot. Gard. 19, 464, (1932). Lloyd C. G. Myc. Writ. **5:** Large Pyrenomycetes II, 25, (1919).

Stromata pulvinate, 7·5—8·0 × 11—16 × 6·5—7·0 mm, sessile or with ill-differentiated stipes 4·5—6·5 × 1·5—5.0 mm. Surface of stroma wrinkled, reddish brown; ectostroma refractive, dark at sight but yielding vinaceous particles in microscopic preparation. Entostroma massive, with zones alternating in hue; dark zones predominant. Perithecia immersed, elliptic, 300—500 × 800—1000μ, close crowded in palisade formation; ostioles invisible, Asci cylindric, 165—325 × 10—11μ; stipes 75—105μ. Spores gibbous, narrow ended, dark brown, 6·0—8·0 × 11·0—16.5μ, ave. 715 × 15·0μ.

Material examined:—

Martin 1818 ex Carroll 177; Coronado, Costa Rica, (1962).

Cultural characters (Plate VI: 3):—

Colonies cottony, dull white, growing freely with coarse texture; mycelial aggregates extensive; margin not distinct, hyphae widely dispersed. Conidia produced by 7 days but not conspicuous. Stain red-brown. Growth rate rapid, 4·7 mm/day at 25°C.

Microscopic characters:—

Primary mycelium undiagnostic; maximum diameter of marginal hyphae = 1·5μ. Secondary mycelium reticulate-tentacular, uniform, 2·5—3·7μ diam.

Conidiophores and conidia (Plate VIII: 4):—

These conform to the *Sporothrix* type seen in *D. concentrica* and *D. occidentale:* 260—330 × 2·0—2·5μ, branched to the first or second degree and branched dichotomously near the apices of the primary axes. Fertile branches narrow, lying freely, with unspecialized heads, 15—42 × 2·2—3·1μ. Conidia acrogenous, on stout sterigmata, botuliform, ends sometimes truncate, white en masse, 3·1—4·3 × 5·6—6·3μ, ave. 3·7 × 6·4μ.

5. **Daldinia vernicosa** (Schw.) Ces. & DN. (Plate IV: 6, 10, 11)

Cesati V. & G. de Notaris Comm. della Soc. Critt. Ital. **1,** 198, (1863). Child M. Ann. Mo. Bot. Gard. 16, 411—486, (1929); Ibid. **19,** 469, (1932). Cooke M. C. Handbook of Australian Fungi 292, (1892). Ellis, J. B. & B. M. Everhart Jour. Mycol. **4,** 111, (1887); N. Amer. Pyren. 661, (1892). Lloyd C. G. Myc. Writ. **5,** 604, (1916); Ibid. **5:** Large Pyrenomycetes II, 25, (1919); Ibid. **7,** 1203, (1923). Spegazzini C. Anal. Soc. Cient. Arg. **90,** 173, (1920), (v. *microspora*) Starbäck K. Bih. Svenska Vet-akad. Handl. **27,** 6, (1901).

sub *Daldinia fissa* Lloyd. Lloyd C. G. Myc. Writ. **7,** 1313, (1924).

sub *Hypoxylon vernicosum* (Schw.) Berk.

Berkeley M. J. Hooker's Jour. of Bot. **6,** 226, (1854); Jour. Linn. Soc. 10, 384, (1869). Berkeley M. J. & M. A. Curtis Proc. Linn. Soc. Bot. **10,** 384, (1867).

sub *Sphaeria cingulata* Lév. Léveillé M. J. H. Ann. de Sci. Nat. Bot. 111, **3,** 47, (1845).

sub *Sphaeria vernicosa* Schw.

Currey F. Trans. Linn. Soc. Lond. **22**, 266, (1859). Durieu de Maisonneuve M. & J. F. C. Montagne Explor. Alger. I, 451, (1846). Schweinitz L. v. D. J. Acad. Nat. Sci. Philad. **5**, 9, (1825); Trans. Amer. Phil. Soc. Philad. NS. **4**, 190, (1832).

Stromata pulvinate, 8·0—35 × 12—36 × 6—18 mm, sessile or with ill differentiated stipes: 2·5—9 × 6—9 mm. Outer layer wrinkled, yellow ochre; ectostroma refractive, dark at sight but yielding vinaceous particles in microscopic preparations. Entostroma massive, partly corky, carbonous and gelatinous, with several cavities present; in this way differing from other species of *Daldinia*. Zones of alternate colouration, not conspicuous and of equal prominence. Perithecia immersed, polystichous, long ovate, 300—600 × 800—1100μ; ostioles not visible. Asci cylindric, sporing part 67—82 × 9—10μ. Spores elliptic, equilateral or gibbous, broad ended, dark brown to black, 5·0—7·5 × 10·0—14.0μ, ave. 6·6 × 12·0μ.

Material examined:—

Ellis & Everhart; (details absent), NYBG. Carroll 174; Payap, Thailand, (1958), (NYBG). Harper; on *Quercus*, Glencoe, Ill., U.S.A., (1902), (NYBG). Martin 891; culture ex C.B.S. (1961). Martin 1829 ex Kramer in Mycol. Herb Kansas 15; Leavenworth, Kansas, (1963). G. W. Martin & Weldon 8342; Panama, (1952), (NYBG).

Cultural characters (Plate VI: 4):—

Colonies silky to cottony, pure white, growing freely with a fine texture; mycelial aggregates extensive. Margin not distinct, entire; hyphae widely dispersed. Conidia formed by 7 days. Stain red brown, in fleck formation. Growth rapid, 10·0 mm/day at 25°C.

Microscopic characters:—

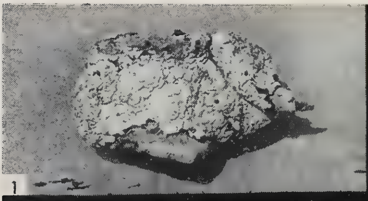
Primary mycelium undiagnostic; maximum diameter of marginal hyphae = 2·3μ. Secondary mycelium with irregular vesiculate swellings, reticulate-tentacular, 1·8—2·8μ in diameter.

Conidiophores and conidia (Plate VIII: 5—7):—

Conidiophores of the simple *Sporothrix* or *Nodulisporium* type: 85—300 × 1·2—2·5μ, unbranched or branched dichotomously or ternately to the first degree near the top of the primary axes. Fertile branches smooth or geniculate, with unspecialized heads, 7·5—26 × 3·1—4·3μ. Conidia pleuracrogenous or acrogenous, sessile or on stout sterigmata, oval or long clavate, white en masse, 3·7—4·3 × 5·6—8·8μ, ave. 4·1 × 6·9μ.

3. *Phylacia* Léveillé M. J. H. Ann. Sci. Nat. Bot. III, 3, 61, (1845).

This genus was founded in 1845 on the type species *P. globosa* Lév, and 5 members were subsequently added. The genus is unique in the Xylariaceae in that the asci have only been observed in one species, *P. turbinata*. Doubt has been expressed by many workers as to whether these fungi really represent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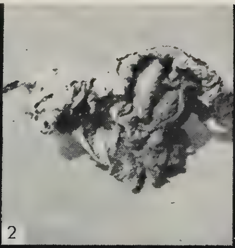
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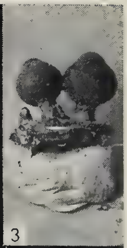
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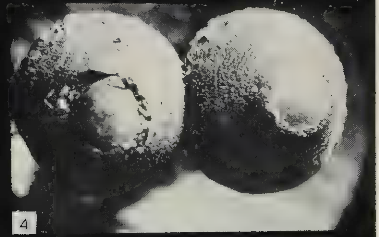
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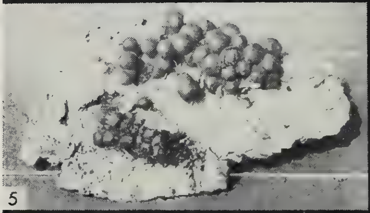
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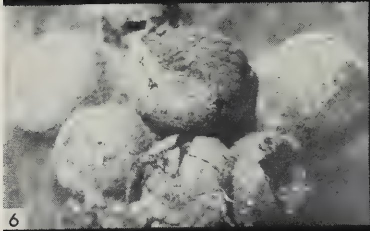
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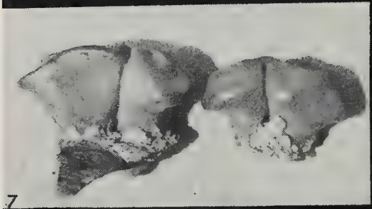
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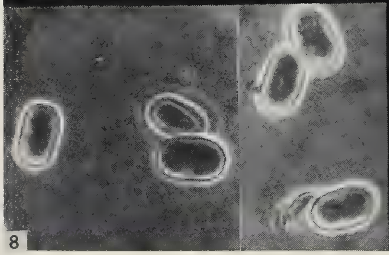
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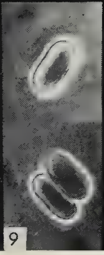
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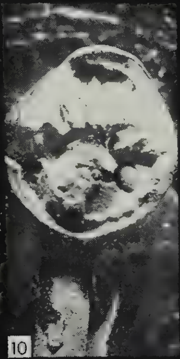
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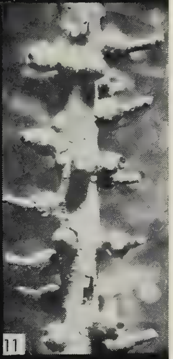
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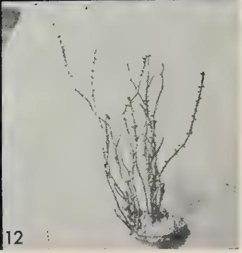
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stromata or acervuli, but the writer concurs with Dennis (1957) in assuming that the elongate locules which are sometimes collapsed to form a hollow interior beneath the crust represent perithecia similar to those in *Camillea*, and that this view should be changed only on positive demonstration of the spores as conidia rather than ascospores.

Lloyd (1917) placed *Phylacia* as a subgenus of *Camillea*, but there are sharp differences between the two groups. *Camillea* usually lacks a definite ectostroma at maturity and the basal tissue is uniform, so that it can reasonably be merged with *Numulariola*. The structure of *Phylacia*, on the other hand, is actually the most complex in the Xylariaceae since differentiation of both ectostroma and antostroma occurs. When material is well preserved the stroma shows the following (See Plate I: 3, 4, 6, 10):—

1. an initial red brown or brown corky veneer, turning black with age—as in *Daldinia* and in *Hypoxylon*.
2. ectostroma brittle refractive, deep red or vinaceous at sight or on dissolving in acetone or alcohol.
3. entostroma well developed, at least $\frac{1}{4}$ of the stroma height, carbonaceous externally and abruptly or gradually becoming corky beneath the perithecia. Often this basal tissue is white and not densely packed; thus resembling *Kretschmaria*.
4. presence of a stipe or some degree of ramification of the stroma.

Phylacia is distinct from all other Xylariaceae in these features, notwithstanding considerable variety in external form. The stromata are usually globose to turbinate, and when branched give rise to clavules of similar form (Plate I: 5). The number of perithecia is presumably always greater than one, and release of the spores in most cases takes place by decay of the upper crust rather than by dehiscence through ostioles (Plate I: 4, 6). Ostioles have only been observed by the writer in *P. globoso-turbinata*, and these are not clearly distinct. The spores are usually cylindric and amber in colour, showing little intra-specific difference, as in *Daldinia* (Plate I: 8, 9).

Plate I. Stromata in *Entonaema*, *Phylacia* and *Thamnomyces*.

1—2. *Entonaema liquescens;* surface and side views (×0·75). 3. *Phylacia poculiformis;* side view of "pepper-pot" stroma (×0·75). 4. *Phylacia poculiformis;* surface view showing spore release by attrition of ectostroma, and absence of ostioles (×2·4). 5. *Phylacia sagraeana;* surface view of multiclavulate stroma (×0·75). 6. *Phylacia sagraeana;* surface enlarged to show ectostroma as in (4) and clustered perithecia beneath (×5). 7. *Phylacia turbinata:* side view of stroma (×2·4). 8. *Phylacia turbinata;* broad cylindric spores (×540). 9. *Phylacia sagraena;* narrow cylindric spores (×540). 10. *Phylacia poculiformis;* longitudinal section of stroma showing massive entostroma, upper part carbonaceous surrounding elongate perithecia and basal part corky. Ectostroma is seen separating from the stipe below (×2·4). 11. *Thamnomyces rostratus;* part of fertile stipe (×5). 12. *Thamnomyces rostratus;* whole specimen (×0·4).

KEY TO THE SPECIES

1. Stromata branched, forming subsessile clavulae in long linear or elliptic groups........2
1′. Stromata usually simple though occasionally united and often aggregated............4
2. Clavulae cylindric, apex flat, often truncate; spores 5·5 × 13·0μ
Phylacia surinamensis (Berk. & Cke.) Dennis
2′. Clavulae globose to ovoid, apex convex..3
3. Clavulae 2—3·5 mm in diameter; spores 4·5—6·0 × 9·0—12·0μ
Phylacia sagraeana (Mont.) Dennis
3′. Clavulae usually exceeding 3 mm in diameter; spores 4—8 × 9—15μ
Phylacia globosa Léveillé
4 (1) Stromata definitely stipitate; clava globose at base then conic to form a gently sloping rounded apex; spores 6·0—7·5 × 10·5—13·5μ
Phylacia poculiformis Montagne (Plate I: 3)
4′. Stromata sessile or indistinctly stipitate..5
5. Stromata globular, single or united; spores 6·5—7·0 × 11·5—15·0μ
Phylacia bomba (Mont.) Patouillard
5′. Stromata obconic or turbinate..6
6. Spores 6·5 × 13·5μ; ostioles many, indistinct to vaguely papillate; stromata obconic
Phylacia globoso-turbinata Lloyd
syn. *Camillea globoso-turbinata* Lloyd
6′. Spores 5·5—8·5 × 11·5—14·0μ, ostioles not apparent; stromata obconic to turbinate, flat topped or convex
Phylacia turbinata (Berk.) Dennis

1. **Phylacia sagraeana** (Mont.) Dennis (Plate I: 5, 6, 9)

Dennis R. W. G. Kew Bull. 1957, 324, (1957).
sub *Camillea sagraeana* (Mont.) Berk. & Curt.
Berkeley M. J. Jour. Linn. Soc. Bot. **10,** 384, (1869). Ellis J. B. & B. M. Everhart N. Amer. Pyren. 663, (1892). Lloyd C. G. Myc. Writ. **5:** Large Pyrenomycetes I, 7, (1917); Ibid. **7,** 1281, (1924). Miller J. H. Monog. Univ. Puerto Rico B **2,** 197, (1934). Rehm H. Hedwigia **28,** 300, (1889). Rick. J. Brotéria ser. bot. **25,** 39, (1931). Theissen F. Ann. Mycol. **7,** 7, (1909).
sub *Hypoxylon sagraeanum* Mont.
Currey F. Trans. Linn. Soc. Lond. **22,** 264, (1859). Montagne J. F. C. in Sagra; Hist. Cuba, 343, (1838—1842); Ann. Sci. Nat. II, **17,** 123, (1842).

Stromata ovoid to globose, indefinitely ramified with 4—100 clavulae, each 2·0—3·5 × 2·8—4·5 × 3·1—9·0 mm; apices flat to rounded or sometimes gently conic; stipes definite, smooth black, 1·2—2·2 × 3·0—4·5 mm. Outer layer smooth, black; ectostroma refractive, black at sight but disintegrating into vinaceous particles on microscopic section. Entostroma massive, carbonous towards the exterior, basal tissue corky; solid, concolorous, dull brown to black. Perithecia immersed, about 40 per clavule, tightly packed, vertically oriented, long elliptic, 300—400 × 1,000—1,400μ; ostioles apparently absent. Asci not seen. Spores cylindric with parallel sides, amber, subhyaline to translucent, with prominent hyaline sheaths, 4·5—7·0 × 7·5—14·5μ, ave. 5·4 × 10·7μ.

Material examined:—

Martin 1516; San Blàs, Mexico, (1962). Martin 1792 ex Carroll 170; Dominical, Costa Rica, (1962). Seaver in N.Y. Bot. Gard.: Plants of Trinidad, B.W.I., 3124; Matchepoorie, Trinidad, (1921), (NYBG). Weston; Barro Colorado Island, Panama, (1928), (AA).

Cultural characters:—

Colonies felty, appressed, uniform dull white; margin not distinct, lobed; hyphae lying compact. Stain olive green, conspicuous beneath mycelium, growth rapid, 4·5 mm/day at 25°C.

Microscopic characters:—

Primary mycelium undiagnostic; maximum diameter of marginal hyphae = 2·0μ. Secondary mycelium uniform, reticulate, 3·0—6·0μ diameter.
Conidiophores and conidia: sterile.

2. **Phylacia turbinata** (Berk.) Dennis (Plate I: 7, 8)

Dennis R. W. G. Kew Bull. **1957**, 324, (1957).
sub *Camillea turbinata* (Berk.) Speg.
Ellis J. B. & B. M. Everhart Bull. Lab. Nat. Hist. Univ. Iowa **2**, 411, (1893). Von Hohnel F. Denkschr. Akad. Wiss. Wien. Math. naturw. Klasse **83**, 26, (1927). Lloyd C. G. Myc. Writ. **5**: Large Pyrenomycetes I, 4, (1917); Ibid. **7**, 1280, (1924). Rick J. Brotéria ser. bot. **25**, 36, (1931). Spegazzini C. Bol. Acad. Nat. Cienc. Cordoba **11**, 509, (1889). Starbäck K. Bit. Svenska vet. abad. Handl. **27**, IX, 4, (1901) (var. *obpatellata*). Theissen F. Ann. Mycol. **7**, 7, (1909). Viégas A.P. Bragantia **4**, 99, (1944).
sub *Hypoxylon turbinatum* Berk.
Berkeley M. J. Jour. Linn. Soc. **15**, 51, (1876).

Stromata stipitate with one or two ovoid to pulvinate fertile heads, sometimes resembling pepper pots, 5·3—7·5 × 5·5—10·5 × 5·5—7·5 mm; stipes ill differentiated or distinct, 2·5—6·0 × 1·3—6·5 mm. Outer layer on clavata in the form of polygonal crusts, reddish brown; ectostroma refractive, dark at sight but yielding rose red particles in microscopic preparations. Entostroma massive, corky at base becoming rigid or carbonaceous towards the exterior. Perithecia immersed, tightly packed, ovate, 800—900 × 1000 × 1200μ; ostioles apparently absent. Asci not seen; quoted by Dennis as globose, 29—42 × 12—15μ; stipes 5—7μ. Spores cylindrical, amber, subhyaline to translucent, 5·0—10·0 × 8·5—16·5μ, ave. 7·6 × 12·7μ.

Material examined:—

Digilio Grassi in Herb. Inst. Miguel Lillo 5596; Urundel Salta, Argentina, (1961) (NYBG). Martin 901 ex Schroeder; Petén, Guatemala, (1961). Martin 1508, 1517, 1567; San Blàs, Nayarit, Mexico, (1962). Smith; Mexico, (1895), (NYBG).

Cultural characters:—

Colonies canescent to felty, dry, appressed, lobed; margin not distinct, hyphae compact, colourless. Stain very prominent: yellow, amber, or olive green. Growth rate moderate, 3·6 mm/day at 25°C.

Microscopic characters:—

Primary mycelium undiagnostic; maximum diameter of marginal hyphae = 1·5μ. Secondary mycelium uniform, loose to reticulate, 1·2—2·5μ diam.
Conidiophores and conidia:— Sterile.

1. *Thamnomyces* Ehrenberg C. G. Hortae Physicae Berolinenses 79, (1820). (See also Lloyd C. G. Mycol. Writ. **6**, 904—944, (1920)).

This genus comprises 5 species in which the stroma is elongate, dendroid and usually branched. The form is quite distinct from *Phylacia* but is definitely related to it in structural features (Plate I: 11, 12). The ectostroma is corky or brittle-refractive and pigmented, bearing a brownish-red or purple veneer when young. The entostroma surrounding the perithecia and often beneath them is relatively massive, rigid and carbonaceous, while that in the centre of the stroma is softer, corky and dark brown, not apparently turning white as in *Phylacia*. The perithecia are remarkable in that they are either enclosed in apical clavules (sub-gen. *Scopimyces*) or are clearly evident in outline and arise from the sides of the stipes. This condition is a clear parallel to that in *Kretzschmaria* and *Xylaria*.

KEY TO THE SPECIES

1. Stromata dichotomously branched; perithecia embedded in the apices (sub genus *Thamnomyces* Henn.) 2
1′. Stromata little branched, bearing long beaked perithecia scattered along the axis. (sub genus *Scopimyces* Henn.) 4
2. Clavulae uniperitheciate 3
2′. Clavulae with more than 1 perithecium; spores 4·0 × 8·0μ
    Thamnomyces dendroidea Cke. & Massee
3. Spores 4·0 × 7·5μ
    Thamnomyces chamissonis Ehrenberg
3′. Spores 6—8 × 13—19μ
    Thamnomyces camerunensis Hennings
4 (1) Axis less than 1 mm thick; perithecia sessile; ascospores 3·5 × 7·5μ
    Thamnomyces rostratus Montagne (Plate I: 11, 12)
4′. Axis 1—2 mm thick; perithecia short-stalked; ascospores 4·5—5·5 × 11—12μ
    Thamnomyces fuciformis Berkeley.

No material has been found yet to yield cultures.

Series II. *Numulariola* House H. D. N.Y. State Museum Bull. **266,** 49, (1925).

This genus was erected by House with scant definition of its limits. In the writer's opinion (Martin, 1967) the genus should include as well as the original species, species of other erumpent genera formerly considered quite distinct. Although erumpent species occur sporadically in diverse groups, there is nevertheless a sufficiently strong and widespread correlation between erumpent

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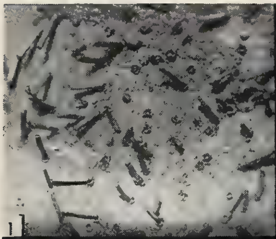
PLATE II. Stromata in *Numulariola*.

1. *Numulariola* (*Camillea*) *bacilla* (×1·25). 2. *Numulariola* (*Camillea*) *leprieurii* (×1). 3. *Numulariola* (*Camillea*) *mucronata* (×1). 4. *Numulariola* (*Camillea*) *macromphala* showing transition from cylindric to aplanate form (×1). 5. *Numulariola* (*Camillea*) *cyclops:* form resembling *N. discreta* and relatives (×1). 6, 8. *Numulariola discreta;* side and surface views of short cylindric stromata (×1). 7, 9. *Numulariola kalchbrenneri* (×0·3) and (×2). 10. *Numulariola repanda* (×0·9). 11. *Numulariola signata.* Note scaling off of ectostrama at left (×0·9). 12. *Numulariola polysperma* (×1·25). 13. *Numulariola* (*Peridoxylon*) *petersii.* Note thick ectostroma persistent at margin (×0·9).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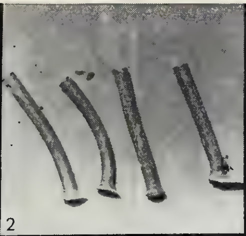
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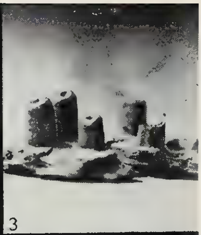
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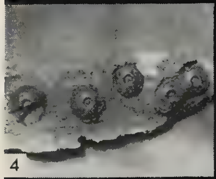
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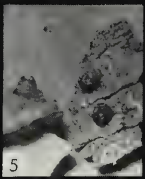
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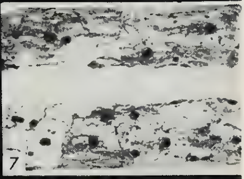
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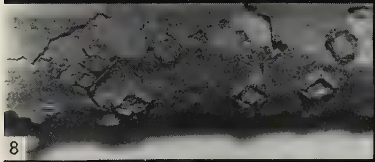
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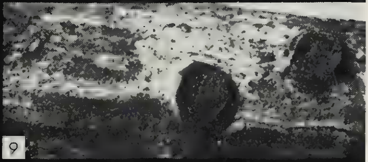
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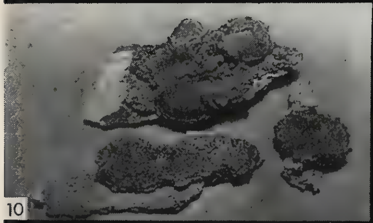
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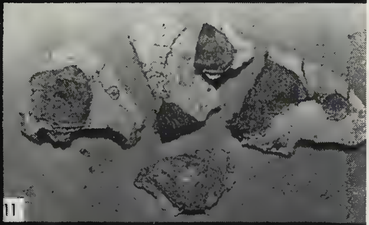
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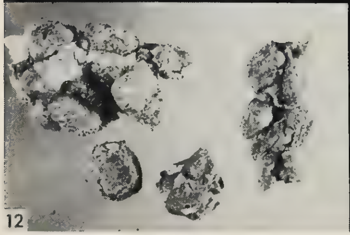
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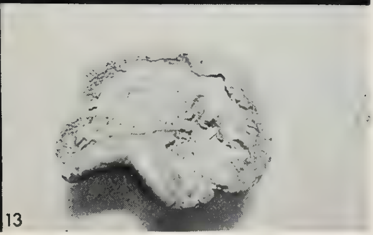
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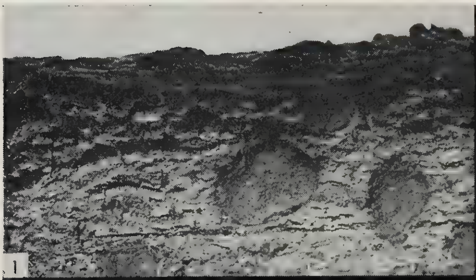
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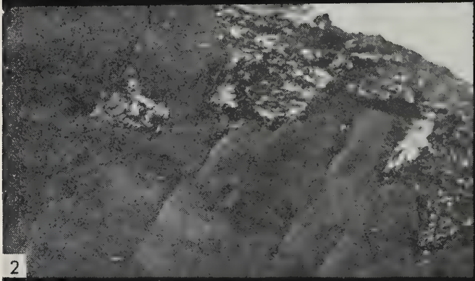
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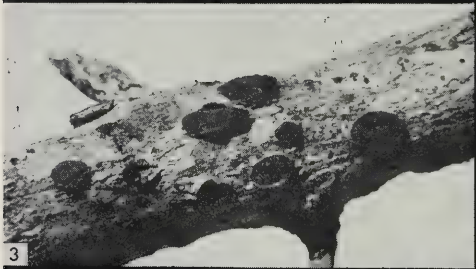
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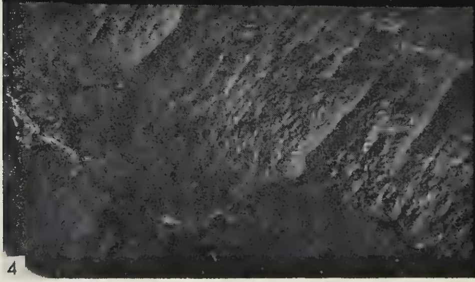
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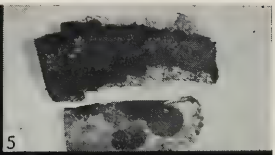
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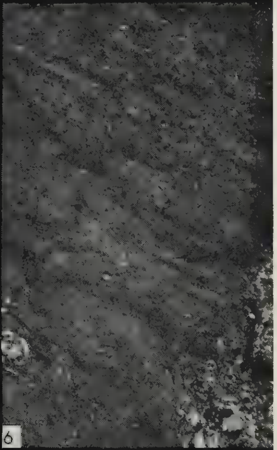
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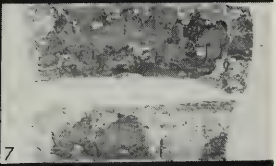
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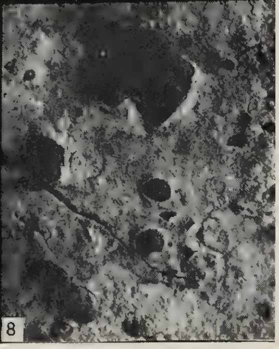
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development, lack of pigment, aplanate or cylindric form, complete immersion and close packing of perithecia and potential involvement of the ectostroma with the substrate that the combination of these should override the relatively unimportant characters selected to establish several small genera, and serve as the basis of a single inclusive genus. These small genera deserve a brief review.

1. *Nummularia* Tulasne L. & C. Selecta Fungorum Carpologia II, 319, (1863). See Plate II: 6—9; Plate III: 3.

This was established by Tulasne and based on *N. discreta* (Schw.) Tul., which had a small cupulate stroma with a concave surface. According to Tulasne, the other chief characteristic was the innate formation of conidia between the stroma and bark. This was not completely explained, and later workers often did not understand what was meant. It was certainly ignored in the delimitation of other genera such as *Camarops* and *Camillea*. Consequently, the first feature has been the most widely discussed. Miller (1932, p. 131) and Shear (1938) did not consider *Nummularia* to be far from *Hypoxylon*, and Miller transferred back to *Hypoxylon* many species, e.g., *N. mediterranea* (DN.) Sacc., that were effuse and flattened and which had been previously placed in *Nummularia*. Miller's emendation of *Nummularia* to include cupulate forms only while retaining the diffuse ones in *Hypoxylon*, was, however, unsatisfactory since it evaded the manner of development.

Another more serious difficulty against the retention of *Nummularia* as a generic name was the fact that *Nummularia* Tul. was preceded by the angiosperm genus *Nummularia* Riv. ex Rupp (1745) and by its synonym *Nummularia* Gilib. (1781).* Although *Nummularia* is now placed in synonymy with *Lysimachia* (Primulaceae), the name is not available for the fungal genus.

2. The Applanata group of *Hypoxylon* Miller J. H. World Species of *Hypoxylon*, 100, (1961). See Plate III.

The Applanata section was erected by Miller for the large number of effuse erumpent species formerly placed in *Nummularia* by workers subsequent to Tulasne. The writer does not consider that they have much affinity with the type species of *Hypoxylon*, *H. fragiforme* (Pers. ex Fr.) Kickx and other representative species, because the latter lack the peculiar combination of characters just discussed which are present in the Applanata group. On critical examination

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PLATE III. Stromata in *Numulariola* continued.

1, 2, 3, 4, 6, 8 (×2). 5, 7 (×0·3).

1. *Numulariola microplaca*. 2. *Numulariola uni-apiculata*. 3. *Numulariola exutans;* restricted elliptic form. 4. *Numulariola nummularia*. 5. *Numulariola mediterranea*. 6. *Numulariola mediterranea*. 7. *Numulariola uni-apiculata*. 8. *Numulariola merrillii*.

* J. D. Hooker and B. D. Jackson, Index Kewensis, II, 320, Clarendon Press, Oxford, 1895.

many species show intergrades from the effuse to the cupulate form of stroma reserved for *Nummularia*. Several have extended ostiolar necks characteristic of *N. discreta*.

3. *Camarops* Karsten P. A. Mycologia Fennica II, 6 & 53, (1873). See Plate II: 12; Plate IV: 12.

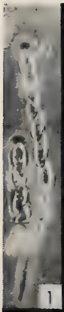
The genus *Camarops* was based on the single species *C. hypoxyloides* Karsten. The structure is patently similar to that in the Applanata section but the perithecia are elongate, subcylindric to tubuliform. The original description which states that the spores are spuriously septate is in error, and that character must be discarded. Two other species, *C. polyspermum* (Mont.) Miller (1930) and *C. microsporum* (Karst.) Shear (1938) are now included. The perithecia are tubular in the first species but ovate in the latter. Tubular perithecia occur in other unrelated species, e.g., *Hypoxylon haematostroma* Mont. and *H. jecorinum* Berk. and Rav. (sect. Euhypoxylon), and also in the next erumpent genus *Camillea*, so it can hardly be used as a character of generic value. On the other hand, the erumpent nature and general stromal features clearly relate it to the Applanata section and to *Nummularia*.

4. *Camillea* Fries E. M. Summa Veg. Scand. 382, (1849). (See also Lloyd C. G. Myc. Writ. **5**: Large Pyrenomycetes I, 2, (1917)).

This genus is hard to separate from the cupulate forms of *Nummularia* since there are several of the latter (*N. broomeiana* (B. & C.) Mill., *N. artocreas* (Massee) Mill.) which are partly raised above the substrate level. The latter feature together with the tubular perithecia are, however, constant in the small number of species placed under *Camillea*. In form the stroma ranges from pulvinate-cylindric (*C. cyclops* Mont.) to elongate cylindric and rod-shaped in which the entostroma beneath the perithecia is linearly developed (*C. leprieurii*

Plate IV.

1—6. Ascus structure. 1. *Numulariola tinctor* (×210). 2. *Numulariola tinctor* (×540); showing elongate composite ascal plug. 3. The same; showing horizontal division within ascal plug. 4. *Numulariola merrillii* (×210). 5. *Numulariola merrillii* (×540); normal discal plug. 6. *Daldinia vernicosa* (×540); narrow plug at apex of dehiscing ascus.
7—10. Spore types. 7. *Numulariola bacilla;* broad crescentic (×540). 8. *Numulariola polysperma;* obconic, with narrow proximal ends (×540). 9. *Numulariola pithodes;* elliptic spores (cf fig. 5) each with proximal appendage or truncate end (×210). 10. *Daldinia vernicosa* gibbous (×210).
11—16. Details of stroma. 11. *Daldinia vernicosa;* vertical section through stroma showing ectostroma, polystichous perithecia, zonate entostroma with cavities and corky gelatinous matrix (×20). 12. *Numulariola polysperma;* vertical section showing carbonous entostroma, elongate perithecia and corky basal tissue (×10). 13. *Numulariola tinctor;* ectostroma (light) worn away to reveal papillate ostioles and carbonaceous entostroma beneath (×10). 14. *Numulariola repanda;* vertical section through stroma showing perithecia and carbonous entostroma above, basal tissue below (×20). 15. *Numulariola polysperma;* ostioles indistinct or raised umbilicate (×5). 16. *Numulariola* sinuosa; prominent umbilicate ostioles in entostroma (×2).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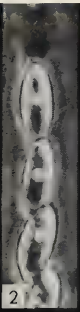
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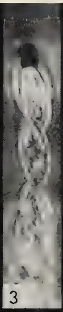
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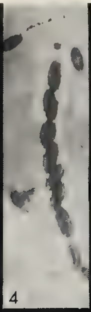
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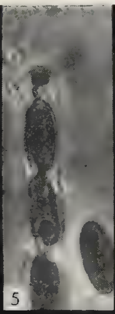
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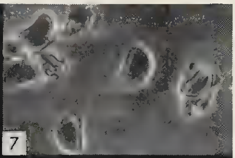
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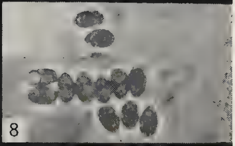
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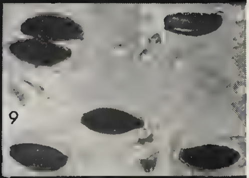
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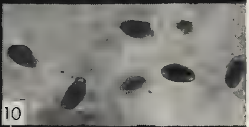
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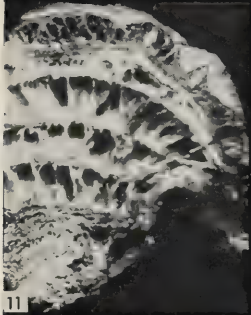
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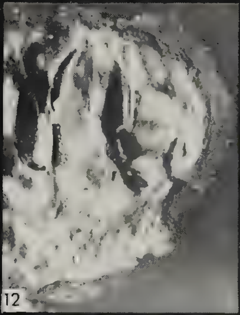
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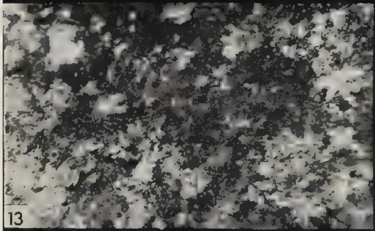
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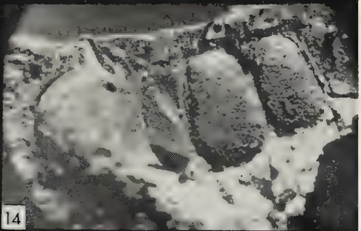
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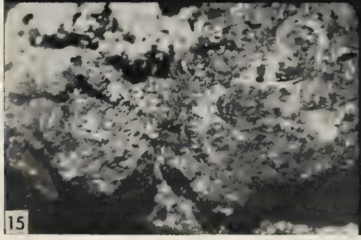
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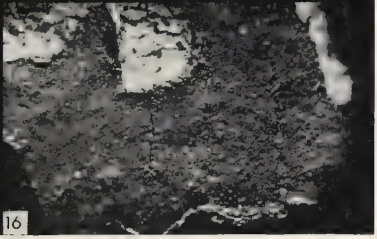
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Mont., *C. bacillum* (Mont.) Sacc.). It is difficult to speak of a "stipe", however, because there is no clear outward differentiation between the fertile and sterile portions such as occurs in *Xylaria* and *Kretzschmaria.*

In development the stroma grows between the bark and the wood and ruptures the former in such a manner that it falls away without trace, leaving it apparently superficial. In all the species examined except *C. bacillum* the outer layer disappears in the process so that the shiny surface of the carbonous entostroma is exposed to view. *C. bacillum* differs from the others in persistence of a thin slate grey corky ectostroma and in a convex rather than concave apical portion, both features being typical of the Applanata section. *Camillea* also exhibits a wide range of spore shape. Thus there is no clear basis for the erection of this genus.

5. *Theissenia* Maublanc A. Bull. Myc. Soc. de France, **30,** 48—53, (1914).

This is a monotypic genus comprising *Theissenia pyrenocrata* (Theiss.) Maubl. Theissen originally placed this in *Ustulina* from which it was removed because of its erumpent development. As it stands, it is unsatisfactory because of the almost complete lack of definition, since it was based in part on superficial characters such as the large size of the perithecia and partly on the reported gelatinous nature of the tissue between the perithecia. The writer finds that the material in the New York Botanical Garden Herbarium and in the Miller Herbarium corresponds to the Applanata section in general characters, and that there are no grounds for erection of a distinct genus.

6. *Peridoxylon* Shear C. L. Mycologia **15,** 126, (1923). See Plate II: 13.

This is another monotypic genus. The stroma is large repand, and varies from being evenly attached to cupulate and indistinctly stipitate. From the material examined of *P. petersii* (B. & C.) Shear in the New York Botanical Garden Herbarium the stroma appears to be erumpent in most cases but it is difficult to find out whether this is always so. In other respects the structure is similar to *Camarops*, with elongate perithecia and ostiolar necks.

7. *Bolinia* Nitschke T. Pyrenomycetes Germanici 26, (1867).

This genus was founded by Nitschke for the polystichous species of *Nummularia*, the type being *B. tubulina* (A. & S.) Nits. ex Shear. The polystichous character is not a sound choice since it is also present in various unrelated species of *Hypoxylon* (*H.* (*rubiginosum* Pers. ex. Fr., *H. novemexicanum* Mill.) and has little value for creation of a major taxon.

The writer proposes a single generic name to cover all the groups outlined. There are three synonyms of *Nummularia* available: *Biscogniauxia* Kuntze (1891), *Kommamyce* Nieuwland (1916), and *Numulariola* House (1925). The latter is selected because it was described to cover both the type of the genus

Nummularia, *N. discreta* (Schw.) Tul. and the type of the Applanata section of *Hypoxylon*, *Hypoxylon nummularium* Bull. ex Fr. The other generic titles referred only to *Hypoxylon nummularium* or its synonym *Nummularia bulliardi* Tul. and were not made applicable to the cupulate forms. The following characters appear to be basic to *Numulariola*, even though they may not all have been previously recognized:

a. erumpent development, but with the ectostroma involved with the outer layer of the substrate and only partially retained at maturity, if at all. (In the other genera, the ectostroma of erumpent species is found to be separate from the substrate). (See Plate IV: 13);
b. aplanate, discoid, cylindric to tubular form of stroma;
c. surface of stroma varying from convex to concave, sometimes within the same species; concave stromata are rare elsewhere;
d. ostioles varying from papillata to umbilicate, partly depending on the degree of erosion of the ectostroma which can mask papillate ostioles beneath. (See Plate II: 9; Plate III; Plate IV: 13, 15, 16)
e. development of a sterile stroma margin in a proportion of the species
f. rigid black "carbonous" entostroma surrounding the perithecia, becoming corky in texture basally (See Plate IV: 12, 14);
g. closely packed perithecia of variable form;
h. discoid ascal plugs (Plate IV: 1—5); this feature is almost constant in all the species where asci were found and directly relates the genus to *Lopadostoma*, but *Lopadostoma* is considered separate because of its valsoid structure;
i. Spores elliptic to oval or subglobose; when inequilateral the germ slit is on the least convex side, in contrast to *Hypoxylon* except for the section Entoleuca. (See Plate IV: 14, 7—9)

KEY TO THE SPECIES

1. Stroma cylindric or tubular, at least 3 mm high above the substrate surface
.... (section Camillea Mont.) 2
1′. Stroma aplanate to short cylindric, or irregular in form; if greater than 3 mm high above the substrate, then not tubular
.... (Section Innata) 7
2. Stroma tubular to rod-shaped, narrow, at least 4 times as long as wide
....3
2′. Stroma short cylindric, sometimes decussate...............................5
3. Stroma with concave upper surface surrounding a single central mucronate ostiole; spores not available
Numulariola mucronata (Mont.) Martin (Plate II: 3)
syn. *Camillea mucronata* Montagne
3′. More than ostiole present; papillate to indistinct...........................4

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*Decimal figures represent averages of at least 10 spores; integers mere range of dimension

4. Stroma with concave upper surface, rimose, with ostioles close to the margin; upper part of stroma bluish white and base darker; spores obconic with proximal end narrow, amber, 7·0 × 15·0μ*
Numulariola leprieurii (Mont.) Martin (Plate II: 2)
syn. *Camillea leprieurii* Montagne

4′. Stroma with concave upper surface, ostioles central, outer layer (ectostroma) dull brown, uniform; spores oval-elliptic, crescentic, broad-ended, medium brown, 4·0 × 7·0μ
Numulariola bacilla (Mont.) Martin (Plate II: 1, Plate IV: 7)
syn. *Camillea bacillum* (Mont.) Saccardo

5. (2) Margin rimose but simple 6

5′. Margin rimose and recurved at opposite ends to form two claw-like projections; spores elliptic, equilateral, broad-ended, amber, 3·0 × 8·0μ
Numulariola bilabiata (Speg.) Martin
syn. *Camillea bilabiata* Spegazzini

6. Sides of stroma vertical; one fruiting portion only per stroma; spores cylindric, amber, 3·5 × 7·0μ
Numulariola cyclops (Mont.) Martin (Plate II: 5)
syn. *Camillea cyclops* Montagne

6′. Sides of stroma decussate; one to 3 fruiting portions per stroma (stroma aplanate in latter case); spores cylindric, amber, 5·0 × 9·0μ
Numulariola macromphala (Mont.) Martin (Plate II: 4)
syn. *Camillea macromphala* Montagne

7. (1) Perithecia polystichous 8

7′. Perithecia monostichous 10

8. Spores obconic, proximal end narrow, pale brown 9

8′. Spores with both ends similar; stroma erumpent through fissures in the bark, without sterile margin; basal tissue scanty; spores dark brown to black, 4·5 × 9·5μ
Numulariola obscura Martin nov. sp.

9. Stroma with pronounced sterile margin, usually partly covered by substrate at maturity; basal tissue well developed; spores 3·5 × 6·0—6·5μ
Numulariola lutea (A. & S. ex Fr.) Martin
syn. *Bolinia lutea* (A. & S. ex Fr.) Miller
Nummularia lutea (A. & S. ex Fr.) Nitschke

9′. Stroma fertile at the margins, without substrate covering; basal tissue scanty; spores 2·5—3·0 × 4·5—6·0μ
Numulariola tubulina (A. & S. ex Fr.) Martin
syn. *Bolinia tubulina* (A. & S. ex Fr.) Saccardo
Camarops tubulina (A. & S.) Shear
Hypoxylon tubulium (A. & S. ex Fr.) Fries
Nummularia tubulina (A. & S. ex Fr.) Miller

10. (7) Spores obconic, proximal end narrow 11

10′. Spores with both end similar; or if different then spores elliptic 13

11. Ascospores amber to colourless 3·5—5·0 × 7·0—9·0μ; stromata normally less than 1 mm in height, aplanata, effuse
Numulariola punctulata (B. & Rav.) Martin
syn. *Hypoxylon punctulatum* (B. & Rav.) Cooke

11′. Ascospores some shade of brown; stromata normally exceeding 3 mm in height . . 12

12. Stroma large, broadly exposed, aplanate—repand to broad cupulate, with soft thick ectostroma that sloughs off at maturity; perithecia ovate; basal tissue well developed, dull brown; spores medium brown, 4·5 × 7·0μ
Numulariola petersii (Lloyd) Martin (Plate II: 13)
syn. *Hypoxylon petersi* Lloyd
Peridoxylon petersi (Lloyd) Shear

12′. Stroma of medium size, often covered by substrate, cylindric or oval, aggregated; ectostroma slight; perithecia elongate, basal tissue varying in development; spores pale to medium brown, 3·0—4·5 × 5·0—8·5μ
Numulariola polysperma (Mont.) Martin (Plate II: 12)
syn. *Camarops polyspermum* (Mont.) Miller
Hypoxylon atroviride Ellis & Everhart

13. (10) Spores appendiculate, some shade of brown; appendiculus often evanescent leaving truncate proximal spore end..........14
13′. Spores not appendiculate, amber or brown to black..........21
14. Ostioles punctate, each at the base of a depression; ectostroma brown..........15
14′. Ostioles minutely punctate-umbilicate or papillate, not below stroma level; ectostroma in various shades; dull brown, grey or greenish-grey at maturity..........17
15. Perithecia elongate, 120—140 × 250—350μ; spores cylindric-elliptic with broadly rounded distal ends, 5—6 × 10—14μ
Numulariola doidgei (Mill.) Martin
syn. *Hypoxylon doidgei* Miller
15′. Perithecia globose or ovate to oblong compressed, 300—400 × 300—700μ; spores elliptic with narrow rounded distal ends,..........16
16. Spores 7·0 × 8·0—6·5 × 12·5μ (excluding apiculus)
Numulariola grenadense (Mill.) Martin
syn. *Hypoxylon grenadense* Miller
16′. Spores 8·5 × 15·5μ
Numulariola grenadense var. *macrospora* Miller
17. (14) Ostioles papillate or inconspicuous, spores narrow-ended..........18
17′. Ostioles minutely punctate-umbilicate; ectostroma dull brown to greenish-grey; perithecia with tubular ostiolar necks; spores elliptic, equilateral to navicular, normally broad ended, 5·0—7·7 × 9·5—13·0μ
Numulariola uniapiculata (P. & S.) Martin
syn. *Hypoxylon uniapiculatum* (P. & S.) Miller
Nummularia uniapiculata Penzig & Saccardo
18. Ectostroma grey; perithecia with tubular ostiolar necks; spores gibbous, 11·5 × 25·5μ
Numulariola philippinense (Ricker) Martin
syn. *Hypoxylon philippinense* (Ricker) Miller
Nummularia philippinense Ricker
18′. Ectostroma dull brown; perithecial necks short..........19
19. Basal tissue beneath perithecia well-developed, more than ¼ the height of the stroma; ostioles papillate; spores gibbous to navicular, 11·0—13·0 × 21·5—27·0μ
Numulariola pithodes (B. & Br.) Martin
syn. *Hypoxylon pithodes* (B. & Br.) Miller
Nummularia pithodes (B. & Br.) Cooke
19′. Basal tissue beneath perithecia not conspicuous, ostioles indistinct or medium papillate.......... 20
20. Spores equilateral to gibbous, 7·5 × 17·0μ
Numulariola divergens (Theiss.) Martin
syn. *Hypoxylon divergens* (Theiss.) Miller
Nummularia divergens Theissen
20′. Spores gibbous, 11·5 × 21·0
Numulariola divergens var. *macrospora* Miller
21. (13) Spores amber to yellow, or nearly colourless, hyaline to subhyaline..........22
21′. Spores pale to dark brown or black..........38
22. Basal tissue beneath perithecia well developed, more than ¼ the height of the stroma..........23
22′. Basal tissue slight, less than ¼ the height of the stroma..........24
23. Stroma short cylindric, often produced above the wood surface, with distinct warty-verrucose sides; surface of stroma concave; spores navicular, acute-pointed, 4·5 × 13·5μ
Numulariola labella (Mont.) Martin
syn. *Nummularia artocreas* (Cke. & Mass.) Miller
Camillea labellum Montagne
23′. Stroma aplanate, circular to variably effuse, at substrate level or slightly raised, in which case the sides are smooth; surface convex to concave; spores elliptic equilateral to navicular, 4·5—8·5 × 10·0—21·0μ
Numulariola broomeiana (B. & C.) Martin
syn. *Hypoxylon broomeianum* Berkeley & Curtis
Nummularia broomeiana (B. & C.) Miller

24. (22) Perithecia long elliptic to tubular, at least 5 times as long as broad; spores elliptic equilateral, broad-ended, 3·0 × 5·5μ
Numulariola hypoxyloides (Karst.) Martin
syn. *Camarops hypoxyloides* Karsten

24′. Perithecia ovate to elongate elliptic but less than 4 times as long as broad........25

25. Ostioles sulcate with long dorsal decussate grooves, radiating over surface of aplanate stroma; spores gibbous to navicular, narrow-ended 8·5 × 22·0μ
Numulariola sulcata (Starb.) Martin
syn. *Hypoxylon sulcatum* Starbäck

25′. Ostioles horseshoe-shaped, wide sulcate but not elongate......................26

25″. Ostioles entire or not visible...27

26. Ostioles at stromal level, elliptic, spores fusoid, 6·5 × 13·0μ
Numulariola heterostoma (Mont.) Martin
syn. *Hypoxylon heterostomum* Mont.

26′. Ostioles in depressions, spores 8—10 × 25—30μ
Numulariola heterostoma var. *macrospora* Miller

27. (25) Perithecia in definite groups in the stroma, separated by sterile tissue, or occupying centre of stroma and surrounded by wide sterile margin......................28

27′. Perithecia continuous throughout and margin very narrow if present............32

28. Stroma aplanopulvinate to cylindric, raised above substrate level; perithecia in circular groups, opening into as many pits in the surface of the stroma; spores elliptic equilateral, broad-ended, 5·0 × 9·0μ
Numulariola macromphala (Mont.) Martin (Plate II: 4) (effused form)
syn. *Camillea macromphala* (Mont.) Cke.

28. Stroma aplanate, at substrate level...29

29. Perithecia in small valsoid groups, spores elliptic, equilateral to gibbous, proximal ends narrow, 5·0 × 11·5μ
Numulariola flosculosa (Starb.) Martin
syn. *Hypoxylon flosculosum* (Starb.) Miller

29′. Perithecia dispersed, in irregular groups, or grouping not apparent.............30

30. Ostioles umbilicate with raised rim, each sunken in a superficial depression; spores navicular, with narrow ends, smooth, 7·5 × 27·0μ
Numulariola scriblita (Mont.) Martin
syn. *Hypoxylon scriblita* Montagne

30′. Ostioles umbilicate with raised rim, level with stroma surface; spores rough-walled, elliptic equilateral to gibbous, with broad or narrow ends, 5·0—7·5 × 11·5—19·5μ
Numulariola comedens (Ces.) Martin
syn. *Hypoxylon comedens* Cesati

30″. Ostioles without raised rim, spores smooth...............................31

31. Ostioles umbilicate, surrounded by ectostromal remnants that superficially appear as rough truncate discs; spores gibbous, narrow ended, 5—7 × 14—20μ
Numulariola melanaspis (Mont.) Martin
syn. *Hypoxylon melanaspis* Montagne

31′. Ostioles indistinctly papillate; not sunken or with raised margins; ectostroma slight and entostromal surface characteristically shiny; spores equilateral elliptic to cylindric, narrow-ended, 5—7 × 14—24μ
Numulariola cyclisca (Mont.) Martin
syn. *Hypoxylon cycliscum* Montagne

32. (27) Spores small, not exceeding 10μ long.....................................33

32′. Spores exceeding 10μ in length...35

33. Stromata large, irregular, effuse; ostioles clearly narrow punctate-umbilicate; spores equilateral elliptic to cylindric, broad-ended or sometimes obconic; colourless to amber, 3·5—5·0 × 7·0—9·0μ
Numulariola punctulata (B. & Rav.) Martin
syn. *Hypoxylon punctulatum* (B. & Rav.) Cooke

33′. Stromata usually restricted in extent, orbicular; ostioles umbilicate and rather wide mouthed or indistinctly papillate or annulate papillate; spores elliptic to cylindric broad-ended, amber to pale brown, 3·0 × 5·5—2·5 × 7·0μ
Numulariola microplaca (B. & C.) Martin
syn. *Hypoxylon microplacum* (B. & C.) Miller

33″. Ostioles not umbilicate 34

34. Ostioles prominent, tubular; spores cylindric, amber, 2·5 × 5·0μ
Numulariola microspora (Karst.) Martin
syn. *Anthostoma microsporum* Karsten
Camarops microsporum (Karst.) Shear

34′. Ostioles papillate to indistinct, stroma irregularly erumpent, sometimes linear; entostroma surface shiny black; spores cylindric, amber, 2·5 × 5·0μ
Numulariola helvetica (Nits.) Martin
syn. *Nummularia helvetica* (Nits.) Miller

35. (32) Perithecia large, globose to elongate or compressed, 1,800—4,900μ wide and 300—4,500μ high; spores elliptic equilateral, broad-ended or narrow-ended, 5·5—8·0 × 16·0—17·0μ
Numulariola pyrenocrata (Theiss.) Martin
syn. *Theissenia pyrenocrata* (Theiss.) Maublanc

35′. Perithecia smaller, not exceeding 1,500μ in diameter 36

36. Stromata strictly circular to oval, less than 6 mm. in length or diameter; ostioles not visible, at stroma level; spores gibbous, acute-ended, 4·0 × 14·0μ
Numulariola venezuelensis (Mill.) Martin
syn. *Nummularia venezuelensis* Miller

36′. Stromata circular to effuse, ostioles umbilicate or papillate 37

37. Ostioles umbilicate with raised margins; spores navicular to crescentic, narrow-ended, 7·5—8·5 × 24·0—29·0μ
Numulariola glycyrrhiza (B. & C.) Martin
syn. *Hypoxylon glycyrrhiza* Berkeley & Curtis

37′. Ostioles umbilicate or papillate depending on erosion of the brown ectostroma; spores equilateral to navicular, narrow-ended, 6·5—8·5 × 14·5—20·5μ
Numulariola tinctor (Berk.) Martin
syn. *Hypoxylon tinctor* Berkeley

37″. Ostioles papillate, vertices of perithecia evident; stromata orbicular to widely effuse; spores gibbous, narrow-ended, 7—10 × 23—33μ
Numulariola hemisphaerica (Mill.) Martin
syn. *Hypoxylon hemisphaericum* Miller

38. (21) Stromata small, short cylindric, definitely circular or broad oval in outline; upper surface concave (or convex when perithecia elongate); perithecia ovate to elongate cylindric 39

38′. Stromata more effuse, not restricted to any one shape or size, if sometimes circular or elliptic, then upper surface flat or convex and perithecia not elongate narrow ... 43

39. Spores cylindric with rounded ends, 3·0 × 5·0μ, perithecia tubular or elongate oval, 600—800 × 3,500—4,000μ; stromal surface convex
Numulariola cylindrophora (E. & E.) Martin
syn. *Hypoxylon cylindrophorum* Ellis & Everhart

39′. Spores of different shape; perithecia broader; stromal surface concave 40

40. Basal tissue well developed, exceeding ¼ the height of the stroma 41

40′. Basal tissue not conspicuous 42

41. Ostioles umbilicate with raised rim; spores elliptic fusoid, dark brown, 4·5 × 10·5μ; hyaline spore sheath not prominent
Numulariola signata (Morg.) Martin (Plate II: 11)
syn. *Nummularia signata* Morgan

41′. Ostioles umbilicate but at stroma level; spores subglobose, 12·0 × 14·5μ, with conspicuous hyaline sheaths
Numulariola discreta (Schw.) House (Plate II: 6, 8)
syn. *Nummularia discreta* (Schw.) Tulasne
Nummularia discinola (Schw.) Cke.

42. (40) Ostioles umbilicate or not visible; spores elliptic, 5 × 10μ
Numulariola guaranitica (Speg.) Martin
syn, *Nummularia guaranitica* Spegazzini

42′. Ostioles papillate or raised; spores elliptic, fusoid, 5·0 × 10·5—11·0μ
Numulariola kalchbrenneri (Sacc.) Martin (Plate II: 7, 9)
syn. *Hypoxylon kalchbrenneri* Saccardo
Nummularia kalchbrenneri (Sacc.) Miller

43. (38) Basal tissue well developed, exceeding ¼ the height of the stroma 44

43′. Basal tissue not conspicuous..47
44. Interior of stroma with dull yellow pigment, spores broad-ended...............45
44′. Interior of stroma without yellow pigment, spores narrow-ended...............46
45. Stroma small, erumpent through bark and often linear; ectostroma not recognizable; spores equilateral elliptic to cylindric, 3·5 × 8·0μ
Numulariola linearis Martin nov. sp.
45′. Stromata of moderate size, effuse; spores equilateral elliptic, 7·0 × 17·0μ
Numulariola morgani (Mill.) Martin
syn. *Nummularia morgani* Miller
46. (44) Stroma effuse, at least 20 mm long; basal tissue mixed with wood and pale brown to white in colour; ectostroma pale grey tinted purple; spores gibbous, 7·0 × 14·5μ
Numulariola fuscella (Mill.) Martin
syn. *Hypoxylon fuscellum* Miller
46′. Stroma aplanate to broad urceolate, up to 25 mm long, basal tissue discrete, dull white to pale brown; ectostroma dull brown; spores elliptic, fusoid, 5·0—5·5 × 12·0—12·5μ
Numulariola repanda (Fr.) House-Fig. II: 10)
syn. *Nummularia repanda* (Fr.) Nitschke
47. (43) Ectostroma initially saffron, later white to pale cineraceous grey; ostioles umbilicate; spores equilateral to gibbous, broad-ended 4·0—4·5 × 8·5—9·5μ
Numulariola hypophlaea (B. & Rav.) Martin
syn. *Hypoxylon hypophlaeum* (B. & Rav.) Miller
Nummularia hypophlaea (B. & Rav.) Cooke
47′. Ectostroma initially white, later white to dull grey at maturity 48
47″. Ectostroma initially olivaceous or brown, later dull brown or grey black; if feebly persistent then entostroma similar..49
48. Spores equilateral, broad-ended 4·5—5·5 × 10·0—14·0μ
Numulariola cineraceo-lilacina (Miller) Martin
syn. *Hypoxylon cineraceo-lilacinum* Miller
48′. Spores equilateral, broad or narrow-ended, 12·0—13·5 × 24·0—30·0μ
Numulariola atropunctata (Schw. ex Fr.) House
syn. *Hypoxylon atropunctatum* (Schw. ex Fr.) Cooke
Nummularia atropunctata (Schw. ex Fr.) v. Hohnel
49. (47) Ostioles umbilicate, uncarbonized and soft corky, appearing as yellow or pale dots against the darker plane stroma surface; spores equilateral, broad-ended, 7·5 × 15·5μ
Numulariola albosticta (E. & M.) Martin
syn. *Hypoxylon albostictum* (E. & M.) Miller
Nummularia albosticta Ellis & Morgan
49′. Ostioles variable but always rigid and black...............................50
50. Ostioles usually clearly papillate, surface always dull, ectostroma chestnut to dull brown; spores elliptic equilateral to navicular, broad or narrow-ended, chestnut to dark brown, 7·0—9·0 × 15·0—21·0μ
Numulariola mediterranea (DN) Martin
syn. *Hypoxylon mediterraneum* (DN) Miller
Nummularia mediterranea (DN) Saccardo
50′. Ostioles if clearly papillate, then surface smooth and shiny; ostioles normally indistinct papillate to umbilicate or not visible; ectostroma dull brown or olivaceous to black when persistent..51
51. Stroma surface shiny black; stromata usually robust with large perithecia, 250—400 × 800—900μ; spores equilateral broad-ended, 6·0 × 13·5μ
Numulariola nummularia (Bull. ex Fr.) Martin
syn. *Hypoxylon nummularium* Bull. ex Fr.
Nummularia bulliardi Tulasne
51′. Stroma surface glossy to matt, stromata variable in shape but usually less extensive and with smaller tightly packed perithecia...............................52
52. Spores amber to pale brown, subhyaline, elliptic to cylindric, 2·0—3·0 × 5·0—7·0μ stromata restricted, often orbicular; ostioles sometimes annulate papillate
Numulariola microplaca (B. & C.) Martin
syn. *Hypoxylon microplacum* (B. & C.) Miller
52′. Spores darker, stromata not necessarily orbicular...........................53

53. Spores equilateral, or gibbous and not exceeding 8μ long 54
53′. Spores inequilateral and exceeding 8μ long 61
54. Spores equilateral to gibbous, broad-ended, 3·5 × 5·5μ
  Numulariola maculata (Theiss.) Martin
  syn. *Nummularia maculata* Theissen
54′. Spores equilateral, longer 55
55. Spores with prominent gelatinous spore-sheaths, elliptic equilateral with broad or narrow ends, 7·5 × 13·0μ; stromata restricted, oval
  Numulariola cincta (Ferd. & Winge) Martin
  syn. *Nummularia cincta* Ferdinandsen & Winge
55′. Spores without prominent gelatinous spore-sheaths, stromata greatly varying in size 56
56. Spores fusoid with narrow ends 57
56′. Spores broad-ended 58
57. Spores 5·5—6·5 × 10·5—14·0μ, with tapered ends; ubiquitous
  Numulariola exutans (Cke.) Martin
  syn. *Nummularia exutans* Cooke
57′. Spores 6·5—8·5 × 14·5—15·0μ, with abruptly narrow ends; Southern U.S.A. distribution
  Numulariola rumpens (Cke.) Martin
  syn. *Nummularia rumpens* Cooke
57″. Spores 7·0—7·5 × 11·5—14·5μ, broad elliptic with abruptly narrowed ends; warm temperate to subtropical distribution
  Numulariola pseudopachyloma (Speg.) Martin
58. Spores broad oval or elliptic, width usually exceeding half the length 59
58′. Spores narrow elliptic, width usually not greatly exceeding half the length 60
59. Spores 7·0—7·5 × 11·5—14·5μ
  Numulariola pseudopachyloma (Speg.) Martin
59′. Spores 9·0—9·5 × 12·0—12·5μ
  Numulariola macula (Schw.) Martin
  syn. *Hypoxylon maculum* (Schw.) Miller
60. (58) Spores 5·0—8·0 × 10·5—15·5μ
  Numulariola merrillii (Bres.) Martin
  syn. *Nummularia merrillii* Bresadola
60′. Spores 9·0 × 21·0μ
  Numulariola bartholomaei (Peck) Martin
  syn. *Hypoxylon bartholomaei* (Peck) Miller
61. (53) Spores broad-ended, gibbous, 25·0 × 44·5μ
  Numulariola diatrypeoides (Rehm) Martin
  syn. *Nummularia diatrypeoides* Rehm
61′. Spores narrow-ended 62
62. Spores gibbous to navicular, 6·2 × 13·0μ
  Nummularia theissenii (Syd.) Martin
  syn. *Numulariola theissenii* Sydow
62′. Spores gibbous, 8—14 × 14—24μ
  Numulariola australis (Cke.) Martin
  syn. *Nummularia australis* Cooke
62″. Spores gibbous to navicular, 8·0 × 29·5—9·5 × 27·0μ
  Numulariola sinuosa (Theiss.) Martin
  syn. *Hypoxylon sinuosum* (Theiss.) Miller
  Nummularia sinuosa Theissen
  Hypoxylon fragillimuan (Rehm) Miller
  Nummularia fragillima Rehm

Analysis of Species

1. **Numulariola kalchbrenneri** (Sacc.) Martin nov. comb. (Plate II: 7, 9)

sub *Hypoxylon kalchbrenneri* Sacc.
Saccardo P. A. Syll. Fung. **1,** 364, (1882)
sub *Nummularia kalchbrenneri* (Sacc.) Miller.
Miller J. H. Bothalia **4,** 260, (1942).

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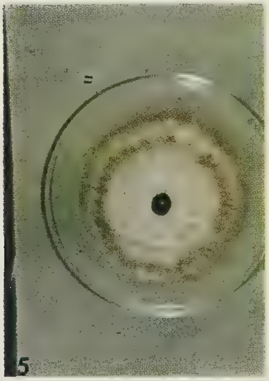
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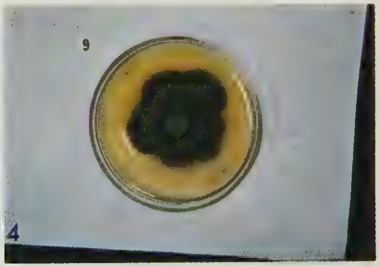

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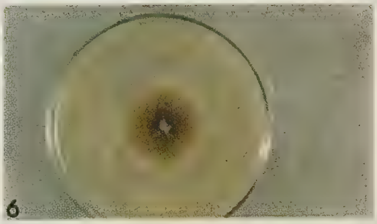
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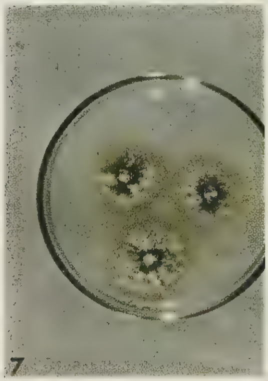
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Stromata orbicular or almost cylindrical, definitely restricted in extent and never widely effused, with smooth, often shiny, characteristically concave surface with raised margin; 2·6—6·0 × 3·2—8·0 × 0·8—0·9 mm. Ectostroma partly persistent, corky, black at maturity; entostroma carbonaceous to corky, dull brown to black. Perithecia immersed, large, flask shaped, generally flattened by mutual pressure, 400—650 × 750—850μ; ostioles at centre of stroma, conspicuously papillate and raised above the stromal level. Asci not seen. Spores oval elliptic, equilateral with bluntly pointed ends, medium brown, 3·5—7·0 × 8·0—13·0μ, ave. 5·0 × 10·9μ.

South African Hosts: The species shows a strong preference for *Gonioma kamassi* and is possibly host-specific. This feature and the somewhat thinner stroma doubtfully separates the species from the north temperate *N. discreta* (Miller, loc. cit.).

Material examined:—

Martin 35, 313, 402, 422, 571, 1188; Nature's Valley, Knysna District, Western Cape, South Africa, (1958, 1959, 1962).

Cultural characters. (Plate V: 6):—

Colonies canescent felty, forming a thick closely appressed mat of aerial mycelium up to 1 mm high, much denser than in other members of this group except *N. nummularia.* At first the mycelium is dull white or nearly so, later it turns dull yellow, often tinted green. The surface of the colony is coarse granulate but smoother than in other species, without the characteristic straggling surface. Margin distinct as a submersed yellow zone 3 mm broad, with effuse hyphae. Conidia dull yellow but not conspicuous, normally produced at centre of the colony after 14 days. Stain diffuse orange to ochre-yellow, very conspicuous, developing after 7 days. Growth rate moderate, 2·8 mm/day at 25°C. Growth on other media broadly similar except on Czapek where initial development is submersed for a far longer period and the stain is less pronounced. On the whole the cultural characters of this species are intermediate between those of *Hypoxylon truncatum* and *N. nummularia.*

Microscopic characters:—

Primary mycelium undiagnostic, marginal hyphae up to 3·8μ in diameter. Secondary mycelium rather slight in quantity, comprising long sparingly branched hyphae 3·6—5·2μ in diameter.

PLATE V. Cultural characters. All cultures on malt at 25°C and 2 weeks old unless stated. 1, 2. *Numulariola merrillii;* bottle cultures. Note central olivaceous conidiophores at right. 3. *Numulariola nummularia;* bottle culture. 4. *Numulariola nummularia;* plate culture. 5. *Numulariola mediterranea;* plate culture. 6. *Numulariola kalchbrenneri;* young culture 1 week old showing smooth instead of coarse surface. 7. *Daldinia eschscholzii;* young culture 1 week old on Czapek, showing characteristic spreading cottony growth. 8. *Daldinia concentrica;* stromata (×0·3).

Conidiophores and conidia (Fig. I: 3):—

The conidiophores are not well-differentiated except by the extremely close branching, and the basal swelling beneath each vertical of fertile branches. They are smooth-walled and colourless, variable in length, 90—150 × 2·6—4·0μ, dichotomously or ternately branched to the first or second degree distally; secondary branches in close clusters of that they are often difficult to distinguish apart. Fertile branches unmodified or swollen, clavate or more commonly elliptic, lying free or in trident formation, 6—40 × 2·5—5·0μ. The conidia are produced in dense clusters, pleuracrogenous, broad oval to narrow clavate, yellow, tinted green en masse, 1·7—3·1 × 4·0—8·0μ, ave. 2·5 × 5·6μ.

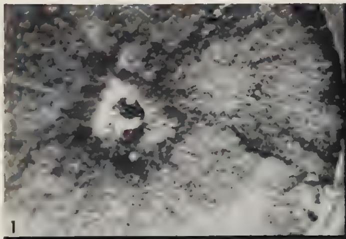
2. **Numulariola polysperma** (Mont.) Martin nov. comb. (Plate II: 12; Plate IV: 8, 12, 15)

sub *Camarops polyspermum* (Mont.) Miller
Dennis R. W. G. British Cup Fungi 179, (1960). Miller J. H. Trans Brit. Mycol. Soc. **15**, 151, (1930); World Species of *Hypoxylon* 140, (1961)
sub *Hypoxylon atroviride* E. & E. Ellis J. B. & B. M. Everhart Proc. acad. nat. Sci. Philad. III, **24**, 346, (1894).
sub *Hypoxylon polyspermum* Montagne
Berkeley M. T. Jour. Linn. Soc. **10**, 385, (1869). Ellis J. B. & B. M. Everhart Jour. Mycol. **4**, 69, (1888). N. Amer. Pyren. 642, (1892). Montagne J. F. C. in Sagra: Hist. de l'ile de Cuba 345, (1838—1842); Ann. Sci. Nat. II, **17**, 124, (1842); Syll. Crypt. 215, (1856). Theissen F. Ann. Mycol. **6**, 536, (1908)
sub *Nummularia ustulinoides* Hennings P. Hedwigia **36**, 227, (1897)
sub *Solenoplea microspora* Starbäck. Lloyd C. G. Myc. Writ. **7**, 1313, (1924).
Starbäck K. Brit. Svensk. Vet. akad. Handl. **27**, IX, 13, (1901). Theissen Ann. Mycol. **7**, 158, (1909).

Stromata erumpent, deeply embedded between bark and wood and usually partly covered by host material at maturity, elliptic or cylindric to somewhat turbinate, with flat to undulating or concave surface, 6·0—24 × 11—44 × 3·0—8·0 mm. Ectostroma dull brown, usually at least partially persistent, smooth; entostroma black and carbonaceous above the perithecia, variably developed at the base, corky, dull brown to black. Perithecia immersed, elliptic to cylindric, 500—1300 × 2900—4000μ, close crowded in palisade formation and sometimes coalescing; ostioles medium papillate, umbilicate, or merely raised and not distinctly either type. Asci cylindric to clavate, with monostichous or distichous arrangement of spores, 50—65 × 4—5μ; stipes 22—30μ.

Plate VI. Cultural characters, continued. All colonies on malt at 25°C and at 2 weeks, unless otherwise stated.

1, 2. *Daldinia concentrica;* great variation in mycelial aggregates and flecks of stain in medium. 3. *Daldinia bakeri;* mycelial aggregate, of small size. 4. *Daldinia vernicosa;* prominent mycelial aggregates. 5. *Daldinia eschscholzii;* mycelial aggregates concealed by coarse growth. 6. *Daldinia occidentale;* close-up of colony surface showing prominent conidiophores. 7. *Daldinia eschscholzii;* typical *Daldinia* colony, with loose, rapidly spreading growth. On Leonian's agar. 8. *Numulariola mediterranea.* 9. *Numulariola pseudopachyloma.* 10. *Numulariola exutans.* 11. *Numulariola uni-apiculata.* 12. *Numulariola microplaca.*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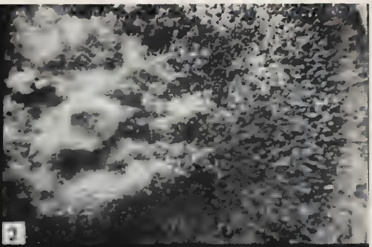
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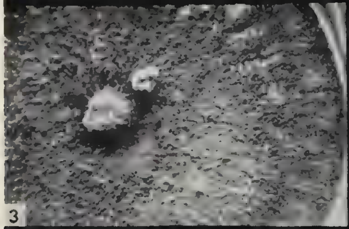
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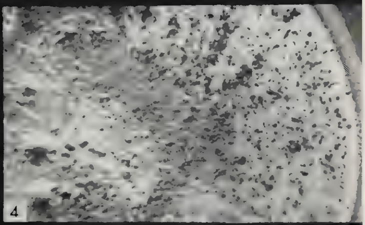
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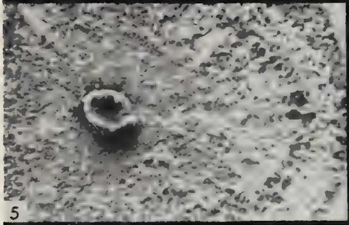
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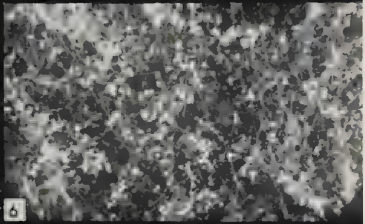
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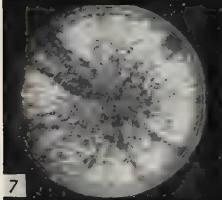
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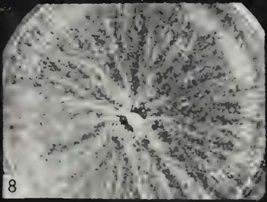
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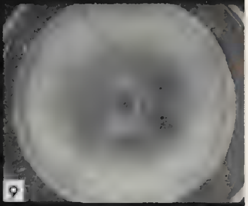
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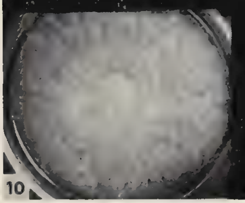
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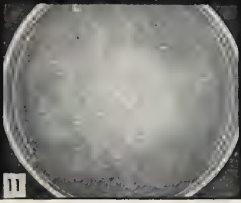
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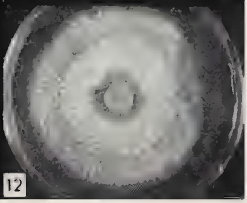
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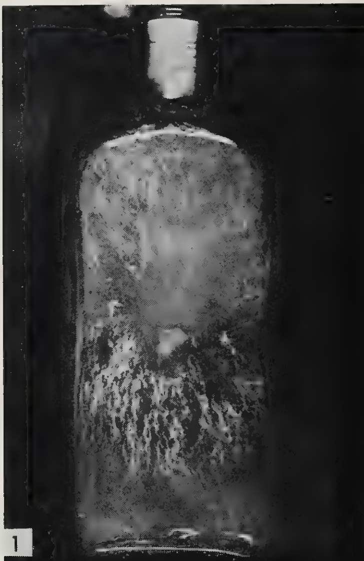

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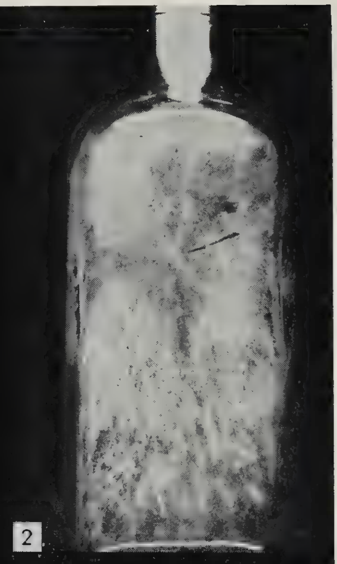

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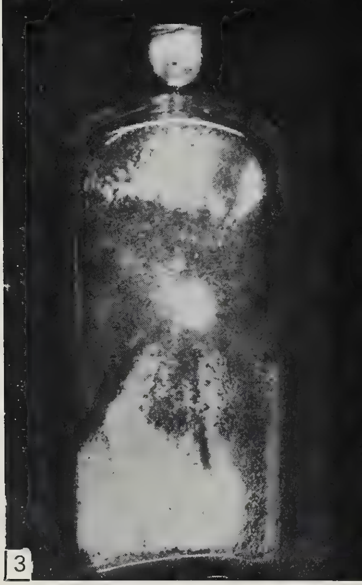

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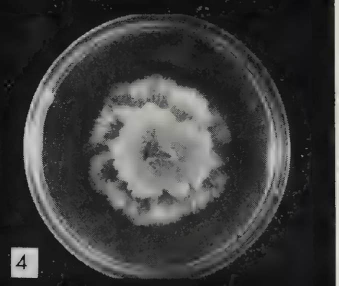

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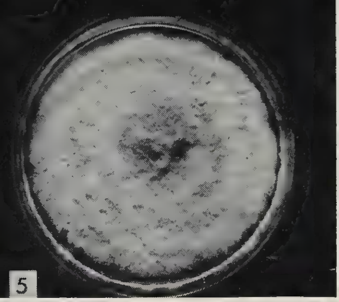

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Spores obconic, distal ends cylindric or elliptic and proximal ends narrowed, pale to medium brown, 2·5—5·5 × 5·0—8·5μ, ave. 3·7 × 6·5μ.

South African hosts: wood unidentified.

Material examined:—
Martin 1836; Blyde River Canyon, E. Transvaal, South Africa, (1968).
sub *Camarops polyspermum* Miller 1817; on *Acer negundo*, Athens, Ga., U.S.A., (1926), (Mill.)
sub *Hypoxylon atroviride* Nuttall; West Virginia, U.S.A., (1894), (NYBG).

Cultural characters (Plate VIII: 4, 5):—

Colonies velvet felty, coarse but not straggling as in other species, with vertical tufts of mycelium produced by 7 days, zonate with one or two broad irregular zones suggestive of *Hypoxylon albocinctum*, mainly pure white. Margin distinct, submerged, segmented to entire; hyphae lying together. Conidia not apparently developed. Stain uniform to mottled, light ochraceous to warm sepia, deepening to ochre brown with age. Growth rate moderate, 3·2 mm/day at 25°C.

Microscopic characters (Plate IX: 1):—

Primary mycelium undiagnostic, maximum diameter of marginal hyphae = 2·0μ. Secondary mycelium barely distinct, loosely organized, amber, 3·4—5·9μ in diameter.

Conidiophores and conidia:—Sterile.

3. **Numulariola microplaca** (Berk. & Curt.) Martin nov. comb. (Plate III: 1)

sub *Anthostoma microplacum* (Berk. & Curt.) Sacc.
Saccardo P. A. Sylloge Fungorum **1,** 298, (1882).
sub *Diatrype microplaca* Berk. & Curt.
Berkeley M. J. Jour. Linn. Soc. **10,** 386, (1869)
sub *Hypoxylon microplacum* (Berk. & Curt.) Mill.
Miller J. H. Mycologia **33,** 77, (1941); World Species of *Hypoxylon* 129, (1961).
sub *Nummularia gracilenta* Sydow. Sydow H. & P. Ann. Mycol. **8,** 37, (1910)
sub *Nummularia lamprostoma* Sydow. Sydow H. Ann. Mycol. **18,** 99, (1920)
sub *Nummularia microplaca* (Berk. & Curt.) Cke.
Cooke M. C. Grevillea **12,** 8, (1883); Handbook of Australian Fungi 291, (1892). Ellis J. B. & B. M. Everhart Jour. Mycol. **5,** 21, (1890); N. Amer. Pyren. 624, (1892). O'Neal C. E. Proc. Indiana Acad. Sci. **1914,** 239, (1914). Saccardo P. A. Syll. Fung. **1,** 298, (1882); Atti R. Instituto Ven. Sci. lett. & art. **3,** 3, (1885).
? sub *Nummularia mölleriana* Henn.
Hennings P. Hedwigia **36,** 228, (1897); Ibid. **41,** 14, (1902).
sub *Nummularia scutata* Henn.
Cooke M. C. Grevillea **12,** 7, (1883). Hennings P. Bot. Jahrb. **14,** 365, (1892). Rehm N. Philipp. Jour. Sci. 8 C, 400, (1913); Leafl. Philipp. Bot. **8,** 2961, (1916).

PLATE VII. Cultural characters, continued.

1—3. The straggling growth type in *Numulariola*. 1. *Numulariola microplaca;* on maize agar. 2. *Numulariola exutans*. 3. *Numulariola uni-apiculata*. 4, 5. *Numulariola polysperma;* 7 × 14—day old colonies, coarse but not straggling. Vertical tufts were present but are not apparent here.

Stromata aplanate, usually restricted and orbicular rather than indefinitely effused, convex to flat, 1·5—4·2 × 3·6—11 × 0·4—0·7 mm. Ectostroma feebly persistent, dull brown. Entostroma somewhat verrucose, dull black, sometimes glossy, with corky dark brown interior. Perithecia immersed, close crowded, broadly oval to somewhat angular, 200—500 × 300—600μ; ostioles medium papillate, indistinct or umbilicate, sometimes surrounded by annular discs representing the sloughing off of the ectostroma as in the Annulata group of *Hypoxylon*. Asci cylindric, 42—100 × 3—4μ; stipes 9—54μ. Spores cylindric or oval, gibbous or navicular, amber to pale brown or pale brownish grey, subhyaline, 1·5—4·0 × 4·5—9·0μ, ave. 2·5 × 5·8μ.

South African Hosts: Unidentified.

Material examined:—

Hesler 10230; Norris, Tenn., U.S.A., (1937), (Mill.). Martin 116, 117, 127, 322, 426, 527; Nature's Valley, Knysna District, Western Cape, South Africa (1958, 1959). Martin 1771 ex Carroll 173; Costa Rica, (1962).

Cultural characters (Plate VI: 12; Plate VII: 1):—

Colonies initially canescent, later coarse but only appearing straggling in bottle culture, with mycelium 2—3 mm high, dull white, subhyline to opaque; mycelial aggregates present in moderate quantity. Margin not distinct, submersed to canescent, effuse but without the long exploratory hyphae characteristic of other species. Conidia produced with age on small floccose tufts of aerial mycelium, greenish grey. Stain light brown deepening to murky. Growth rate rapid, 4·1 mm/day at 25°C. Growth on other media similar though with distinct margins, except on Czapek where mycelium is almost completely submersed with sodden or gelatinous aspect.

Microscopic characters:—

Primary mycelium stout; marginal hyphae up to 4·0μ in diameter. Secondary mycelium loosely organized, 2·3—6·3μ in diameter.

Conidiophores and conidia (Fig. I: 4):—

The conidiophores are normally distinct from the vegetative mycelium by their compact type of branching although they are not tinted, nor do they have warted walls. In form they represent a type of *Acrostaphylus* intermediate with *Sporothrix;* 440—550 × 2·9—3·5μ, branched dichotomously to the second

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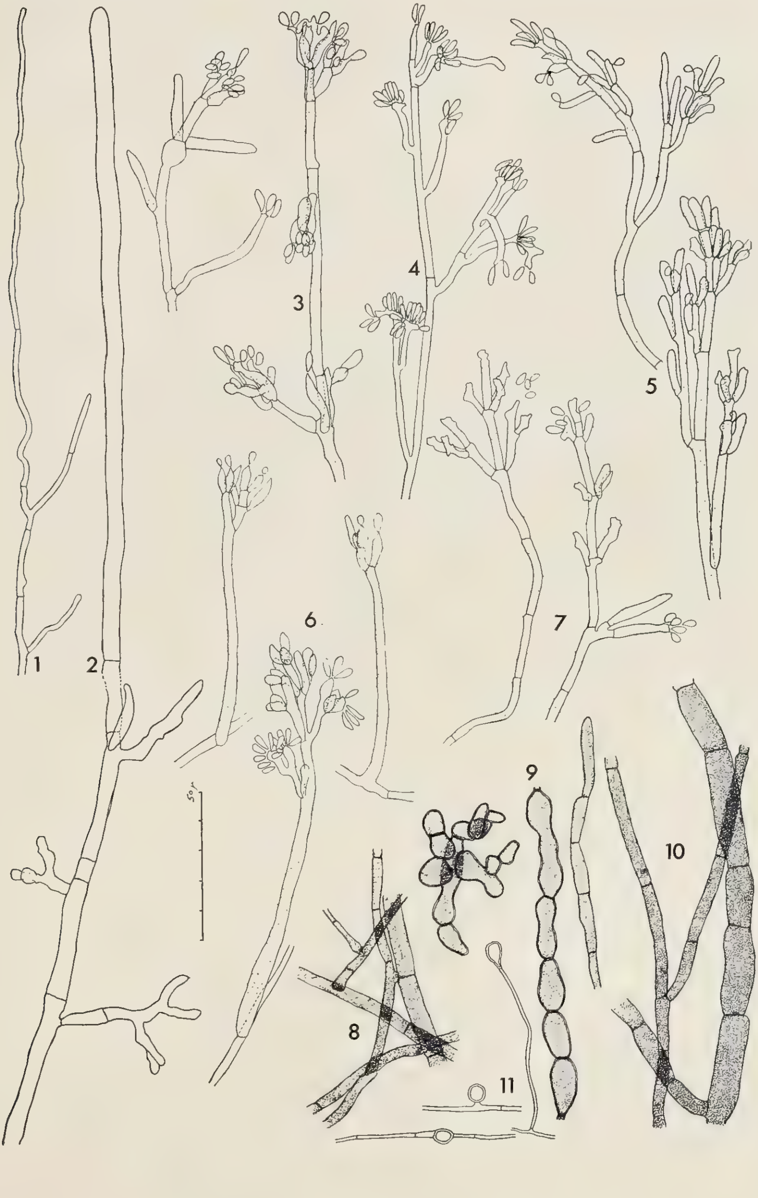
Fig. I. Microscopic Characters.

1—2. Marginal hyphae. 1. *Daldinia concentrica*. 2. *Numulariola mediterranea*.
3—7. Conidiophores and conidia. 3. *Numulariola kalchbrenneri*. 4. *Numulariola microplaca*. 5. *Numulariola uni-apiculata*. 6. *Numulariola nummularia*. 7. *Daldinia eschscholzii*.
8—10. Secondary mycelium. 8. *Numulariola merrillii*. 9. *Numulariola exutans;* young hypha at right, beaded older mycelium on the left. 10. *Numulariola mediterranea*. 11. Chlamydospores of *Numulariola pseudopachyloma*.


50 μ

degree. Fertile branches not markedly swollen but with conspicuously bloated or grotesquely shaped apices; 10—30 × 1·7—3·2μ. Conidia acrogenous, on slender sterigmata, narrow pyriform to elongate elliptic, normally inequilateral with acute or acuminate bases, light olive green en masse, 1·1—2·3 × 4·3—7·7μ, ave. 1·6 × 6·3μ.

4. **Numulariola nummularia** (Bull. ex Fr.) House (Plate III: 4)

House W. D. N.Y. State Museum Bull. **266**, 49, (1925).
sub *Biscogniauxia bulliardi* (Tul.) Kuntze O. Rev. Gen. Pl. 2, 398, (1891).
sub *Hypoxylon ellipticum* Cooke M. C. Handbook of Australian Fungi 296, (1892).
sub *Hypoxylon nummularium* Bull. ex Fr.

Berkeley M. J. in Smith: English Flora **5**, (2) 240, (1836); Grevillea **4**, 94, (1876). Bresadola G. & P. A. Saccardo Malpighia **11**, 294, (1897). Bulliard P. Hist. Champ. de Fr. 179, (1791). Currey F. Trans. Linn. Soc. Lond. **22**, 268, (1859). Dennis R. W. G. British Cup Fungi 178, (1960). Fries E. M. Syst. Mycol. 348, (1823). Fuckel L. Symb. Myc. 236, (1869—1870). Jaczewski A. L. Bull. Soc. Myc. de France **11**, 110, (1895). Lambotte E. Flora Myc. Belge 426, (1880). Lindau G. in Engler & Prantl: Die Natürlichen Pflanzenfamilien I, 483 (1897); Die Mikroskopischen Pilze in Krypt. für Anfänger **2**, (1), 134, (1897). Miller J. H. Jour. Dept. Agric. Puerto Rico **14**, 274, (1930); Trans. Brit. Mycol. Soc. **17**, 128, (1932); World Species of *Hypoxylon* 121, (1961). Quélet L. Champ. Jura & Vosges III, 492, (1875). Rabenhorst G. L. Deutschl. Kryptflor. I, 217, (1844). Rabenhorst L. Kryptflor. Deutsch. II, 847, (1887). Sydow H. & F. Petrak Ann. Mycol. **20**, 186, (1922).

sub *Nummularia anthracina* (Schmidt) Trav.

Rehm H. Ann. Mycol. **6**, 121, (1908); Leaf. Philipp Bot. **6**, 1943, (1913). Traverso J. B. Flor. Crypt. Pyren. **1**, 57, (1906).

sub *Nummularia bulliardi* Tul.

Cooke M. C. Handbook of British Fungi II, 798, (1871); Handbook of Australian Fungi 291, (1892). Ellis J. B. & B. M. Everhart Jour. Mycol. **5**, 20, (1890); N. Amer. Pyren. 624, (1892). Hennings P. Bot. Jahrb. **22**, 78, (1895); Hedwigia **42**, (81), (1903); Ibid. 43, 206 (1904). Kickx J. Flore crypt. Flanders 308, (1867). Lloyd C. G. Myc. Writ. **7**, 1311, (1924); Ibid. **7**, 1353 (1925). Nitschke T. Pyr. Germ. **1**, 60, (1867). O'Neal C. E. Proc. Indiana Acad. Sci. 1914, 239, (1914). Rehm H. Ascomycetes Lokjani lecti in Hungaria, 33, (1882); Hedwigia **28**, 353, (1889). Rick J. Brotéria ser. bot. **25**, 45, (1931). Shear C. L. Mycologia **33**, 318, (1941). Tulasne L. & C. Selecta Fungi Carpologia **2**, 43, (1863).

sub *Nummularia nummularia* (Bull.) Schrot.
Schroter J. in Cohn: Kryptflor. Schlesien 458, (1908).
sub *Sphaeria anthrocina* Schmidt
Kunze G. & J. K. Schmidt Mykologische Hefte I, 55, (1819).
sub *Sphaeria bullata* Hoffman G. E. Vegetabilia cryptogamica 1, 5, (1787).
Hooker W. J. Flora Scotia II, 5, (1821).
sub *Sphaeria nummularia* De Candolle
Berkeley M. J. Ann. & Mag. Nat. Hist. **3**, 398, (1839) De Candolle A. Flor. Fr. **2**, 290, (1805).

Stromata aplanate, erumpent, but robust, effuse, 19—30 × 60—80 × 0·9—1·0 mm, with convex surface. Ectostroma not persistent; entostroma shiny metallic black, mostly carbonaceous, concolorous. Perithecia immersed, close crowded, long ovate, 250—400 × 800—900μ, often several to one ostiole; ostioles papillate and rather easy to distinguish in comparison with those of other species. Asci cylindric, 95—125 × 6—7μ; stipes 20—45μ. Spores oval, equilateral, dark brown, 4·5—7·5 × 9·0—17·5μ, ave. 6·1 × 13·5μ.

South African Hosts: Unidentifiable.

Material examined:—
Martin 275; Alexandria forest, Eastern Cape, South Africa (1958).

Cultural characters (Plate V: 3, 4; Plate VII: 2):—

Colonies felty, with very dense aerial mycelium, eventually 1—3 mm high, white at first (10 days), tinted pale yellow at the site of inoculation, later tinted pale purple throughout. Surface initially coarse but not as markedly so as in other spp, later becoming smooth; mycelial aggregates absent. Margin not distinct, entire with effuse widely separated hyphae. Conidia pale purple, produced after 10—14 days, not conspicuous. Stain at first delicate pink, deepening to purple brown. Growth rate moderate, 3·3 mm/day at 25°C.

Microscopic characters:—

Primary mycelium unusually stout, exploratory hyphae with short and relatively narrow branches; maximum diameter of marginal hyphae = 5·5μ. Secondary mycelium uniform, loosely organized, 1·7—4·5μ diam.

Conidiophores and conidia (Fig. I: 6):—

These are of the usual *Acrostaphylus* type, clearly distinct due to determinate growth, purple tint and warted walls, 90—140 × 3·6—5·9μ; primary axes branched at the apices with 2—4 branches at each node. Fertile branches usually in close verticils, very short and stout, 6—16 × 3—5μ, unseptate, with broad clavate apices. Conidia acrogenous, sessile, pyriform to narrow clavate, purple brown en masse, 1·4—2·6 × 4·3—7·6μ, ave. 1·9 × 5·8μ.

5. **Numulariola merrillii** (Bres.) Martin nov. comb. (Plate III: 8; Plate IV: 4, 5)

sub *Hypoxylon nummularium* var *merrillii* (Bres.) Miller
Miller J. H. World Species of *Hypoxylon* 126, (1961)
sub *Nummularia merrillii* Bresadola G. Hedwigia **56**, 307, (1915)

Stromata orbicular, linear elliptic or indefinitely effused, aplanate, erumpent through bark at maturity or occasionally superficial on decorticated wood, 3·0—16 × 3·6—62 × 0·6—1·0 mm. Surface of stroma concave, flat or convex. Ectostroma and initial stage olive green, ectostroma shed at maturity or becoming partially fused with the entostroma. Ectostroma black, smooth, glossy but not markedly shiny, often with a matt surface, mostly carbonaceous. Perithecia immersed, oval or constricted by mutual pressure, usually close packed, 100—500 × 600—800μ; ostioles papillate or indistinct. Asci cylindric, short stipitate, 75—110 × 6—8μ; stipes 7—25μ. Spores oval to elliptic, equilateral, dark brown, 4·5—9·0 × 8·0—17·5μ, ave. 6·5 × 13·4μ.

South African Hosts: Probably a wide range, known to comprise:—

Maytenus buxifolia, *Olea capensis*, *Royena lucida*, *Trichocladus crinitus*, *Virgilia oroboides*.

Material examined:—

A large quantity of material in the herbaria cited (Martin, 1968). Martin, 18, 23, 39, 61, 70, 300, 321, 423—5, 441—3, 445—7, 449, 480, 1045; Nature's Valley, Knysna District, Western Cape, South Africa, (1958, 1958, 1962). Martin 226; Hogsback, nr Alice, Eastern Cape, South Africa (1958). Martin 263; Kariega River, Eastern Cape, South Africa (1958). Martin 590; Descanso Gardens, Los Angeles, California, U.S.A., (1961). Martin 762, 764, 765, 767, 768, 785—7; O'Brien, Northern California, U.S.A., (1961). Martin 791, 800, 815, 824, 826—8, 838—840, 852, 854, 875; Arcata, N. Calif., U.S.A., (1961). Martin 931; Mazatlàn, Sinaloa, Mexico, (1961). Martin 1059; Santa Paula Mtn., California, U.S.A., (1961). Martin 1553; San Blàs, Nayarit, Mexico, (1962).

Cultural characters (Plate V: 1, 2):—

Colonies at first canescent appressed, then rapidly developing a characteristic loose cottony to felty, dull white, subhyaline to opaque mat about 3 mm high, with coarse straggling hyphae. After 5 days the mycelium becomes tinted with various colours, usually buff or dark brown and rose; olive green near the site of inoculation. Old cultures become overlaid with pleomorphic velvet white mycelium. Mycelial aggregates are absent. Margin not distinct, entire with widely effused submersed hyphae 3—10 mm long. Conidia variable in colour but not conspicuous, appearing by 7—10 days. Stain in varying shades of yellow ochre, yellow pink, and also olive green. Growth rate rapid, 7·1—7·7 mm/day at 25°C.

Microscopic characters (Fig. I: 8):—

Primary mycelium relatively stout as in *N. nummularia*, up to 4·4μ in diameter. Secondary mycelium reticulate, continuous but not as conspicuous as in *N. exutans*, 2·5—6·4μ diam.

Conidiophores and conidia (See Martin (1967), p. 230, fig. 3):—

These are usually sharply distinct by determinate growth, dark colouration, and warted walls, but there is some variation in form from simple types approaching *Sporothrix* to the typical complex multibranched ones with predominantly distal branching that belong to *Acrostaphylus;* 200—750 × 4·3—6·3μ. Usually there is a long stout axis tinted amber or dark brown, terminating in a "head" of closely set fertile branches, 2—4 of these arising at a node. The fertile branches are swollen, clavate or elliptic, and are fairly short, lying free or in trident formation, 6·0—17 × 3·0—4·3μ. Conidia are borne in apical clusters, usually sessile, sometimes borne on slender sterigmata, elliptic to clavate with narrow bases, white en masse, 1·7—2·6 × 3·7—7·2μ, ave. 2·3—4·7μ.

6. **Numulariola exutans** (Cke.) Martin nov. comb. (Plate III: 3)

sub *Anthostoma exutans* Cooke
Saccardo P. A. Syll. Fung. **1**, 296, (1882)
sub *Diatrype exutans* Cooke
Cooke M. C. Jour. Linn. Soc. Lond. **17**, 143, (1878).
sub *Hypoxylon exutans* Cooke
Cooke M. C. Grevillea **8**, 66, (1879). Miller J. H. Bothalia **4**, 255, (1942).

sub *Hypoxylon nummularium* var *exutans* (Cke.) Miller
Miller J. H. World Species of *Hypoxylon* 124, (1961).
sub *Nummularia exutans* Cooke.
Cooke M. C. Grevillea **12**, 8, (1883).

Stromata very similar to that in the preceding species, from which it is doubtfully separated; restricted and regular, oval in outline, or indefinitely effused and irregular, 1·3—9·0 × 2·0—48 × 0·5—1·5 mm; erumpent through bark. Surface of stroma usually convex, rarely flat. Ectostroma evanescent or partially retained (in which case ostioles are invisible), olive green to black. Entostroma carbonaceous, black, glossy to dull matt. Perithecia immersed, close crowded usually angular and constricted by mutual pressure, 130—500 × 450—900μ; ostioles indistinct to papillate. Asci cylindric, short stipitate to nearly sessile, 75—115 × 7—9μ; stipes 7—30μ. Spores oval-elliptic, equilateral ends, rather narrow and somewhat fusoid, rarely gibbous, ends often narrow rounded, medium to dark brown, 4·5—9·0 × 10·0—16·5μ, ave. 6·3 × 12·6μ. South African Hosts: Unidentifiable.

Material examined:—

Martin 382, Rabbit's Wood, Grahamstown, E. Cape, South Africa (1958). Martin 612, 613, 616, 617; Sepulveda Canyon, Los Angeles, California, (1961). Shear; Palmetto, Oviedo, Florida, U.S.A., (1941), (Mill.)

Cultural characters (Plate VI: 10):—

Colonies densely felty to cottony, with coarse straggly surface; aerial mycelium up to 2 mm high, white subhyaline at first, becoming opaque and tinted faint olive green or ochre brown with age. Mycelial aggregates absent. Margin not distinct, canescent, with the usual submersed exploratory hyphae. Conidia inconspicuous, appearing by 7—10 days. Stain at first light ochre brown, deepening to feuille morte or olive green. Growth rate rapid, 6·3—6·9 mm/day at 25°C.

Microscopic characters (Fig. I: 9):—

Primary mycelium broad; marginal hyphae up to 5·3μ diameter. Secondary mycelium loosely organized, characteristically irregular vesiculate or beaded, 3·0—7·5μ diam. Individual cells possibly behave as chlamydospores.

Conidiophores and conidia (Plate IX: 4):—

These parallel *N. merrilli* in range of form, branching varying from lax to extremely compact. They are tinted amber brown or olivaceous, 125—850 × 2·4—6·0μ, branched to the second degree or indefinitely with up to 5 branches per node. Fertile branches rarely narrow, usually swollen, clavate or elliptic, lying freely or in trident formation, 6·0—27 × 1·2—4·3μ. Conidia acrogenous, sessile or on slender sterigmata, subglobose to clavate, with narrow bases, white or ochraceous en masse, 1·2—3·7 × 3·1—6·2μ, ave. 2·5 × 4·5μ.

7. **Numulariola pseudopachyloma** (Speg.) Martin nov. comb.

sub *Hypoxylon nummularium* var *pseudopachyloma* (Speg.) Miller
Miller J. H. World Species of *Hypoxylon* 125, (1961)
sub *Hypoxylon pseudopachyloma* Speg.
Spegazzini C. Bol. Acad. Nac. Cienc. Cordoba **11,** 203, (1887)
sub *Nummularia alabatensis* Yates
Yates H. S. Phillip. J. Sci. **12,** 378, (1917)
sub *Nummularia asarcodes* Theiss.
Theissen F. Ann. Mycol. **6,** 349, (1908)
sub *Nummularia mauritanica* Berk. & Cke.
Cooke M. C. Grevillea **12,** 6. (1883)
sub *Nummularia plana* Petch
Petch T. Ann. Roy. bot. gard. Perad **8,** 166, (1924).

Stromata orbicular, restricted or somewhat effuse but not as extensive as *N. merrillii* and associated species; 2·0—23 × 4·5—48 × 0·4—1·0 mm. Surface of stroma flat or convex, dull brown to black, with a smooth matt surface. Ectostroma not persistent at maturity; entostroma black, carbonaceous, rather thin. Perithecia immersed, close crowded, 200—500 × 300—1000μ; ostioles conic papillate as in *N. mediterranea*, or indistinct. Asci cylindric, short stipitate, 90—120 × 6—10μ; stipes 15—35μ. Spores broadly oval elliptic, dark brown to black, 5·0—10·5 × 9·0—18·0μ, ave. 7·0 × 13·1μ.

South African Hosts: Unidentifiable.

Material examined:—

Martin 262; Kariega River, Eastern Cape, South Africa, (1958). Rick 312; Sao Leopoldo, Brazil, (1906), (Mill.). Shear 26, 30, 39, 278; Hawaii, (1927—1928), (Mill.). Shear; on *Magnolia*, Oviedo, Fla., U.S.A., (1940), (Mill.).

Cultural characters (Plate VI: 9):—

Colonies canescent, appressed with sparse aerial mycelium; surface smooth or slightly cottony, dirty white behind the margin to grey at the centre, uniform or occasionally zonate. Margin not distinct, submersed, dull white subhyaline, entire, with compact to slightly effuse hypae. Stain olive green to grey, eventually turning grey-black with age; produced after 10 days or variable in appearance. Growth rate slow, 1·9 mm/day at 25°C. Growth on other media similar except for Czapek on which it differs by greater luxuriance, forming a coarse felty mat 0·5 mm high, dull white in colour; stain grey-brown.

Microscopic characters (Fig. I: 11):—

Primary mycelium undiagnostic, rather narrow for this species group; marginal hyphae up to 3·0 mm in diameter. Secondary mycelium absent. Chlamydospores are often found on the submersed mycelium 1 week after inoculation. These are oval or pyriform with a thick refractive wall, dark amber or dark brown to black, 5·1—5·7 × 6·0—8·8μ.

Conidiophores and conidia. Sterile.

This species is entirely different from the majority in this group in the peculiar characters of the mycelium in culture.

8. **Numulariola uni-apiculata** (Penzig & Saccardo) Martin (Plate III: 2, 7)

sub *Hypoxylon uni-apiculatum* (Penz. & Sacc.) Miller
Miller J. H. World Species of *Hypoxylon*, 111, (1961).
sub *Nummularia papyracea* Rehm
Rehm H. Leafl. Philipp. Bot. **6**, 2208, (1914)
sub *Nummularia uni-apiculata* Penz. & Sacc.
Penzig O. & P. A, Saccardo Malpighia **11**, 494, (1897).

Stromata aplanate, usually widely effused but sometimes restricted in extent, 2·8—32 × 3·5—80 × 0·3—3·6 mm; with smooth, rarely wrinkled matt surface when young, sometimes becoming glossy at maturity. The species is distinguished by its usually narrow breadth, punctate or indistinct ostioles and the dull brown to greenish grey hue of the persistent ectostroma. Entostroma brown, corky rather than carbonaceous between the perithecial. Perithecia relatively small, oval, closely packed, 150—900 × 180—2000μ; ostioles umbilicate. Asci cylindric, 95—145 × 7—8μ; stipes 17—33μ. Spores broadly oval, equilateral, gibbous or navicular, dark brown to nearly black, with broad obtuse proximal appendages, 4·5—9·0 × 8·5—14·5μ, ave. 6·1 × 11·4μ.

South African hosts: *Kiggelarıa africana.*

Material examined:—

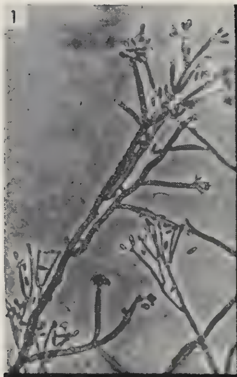
Deighton in IMI 58582; on *Hymenocardia lyrata*, Njala; Sierra Leone, (1954), (CMI). Martin 372; Nature's Valley, Knysna District, Western Cape, South Africa, (1958). Rehm; Mt. Maquiling, Los Banos, Laguna, Philippines, (1913), (Mill.). Shear & Stevens 23; Mauna Loa, Hawaii, (1928), (Mill.).

Cultural characters (Plate VI: 11; Plate VII: 3):—

Colonies at first loosely felty, becoming dense with age, forming a mat up to 2 mm high of white subhyaline aerial mycelium with the normal coarse straggling surface. General features are similar to those of *N. microplaca* but the mycelium is pure white without discolouration by conidia; margin not distinct, canescent to submersed, entire, effuse, with long pioneer hyphae extending up to 5 mm. Stain light buff to ochre brown appearing after 2 weeks and deepening slightly with age. Growth rate rapid, 5·1 mm/day at 25°C.

Microscopic characters:—

Primary mycelium broad, marginal hyphae up to 7·7μ diameter; side branches of similar diameter and length. Secondary mycelium characteristic, loose, light brown to colourless, hyaline, comprising long branched hyphae 2·7—5·1μ in diameter.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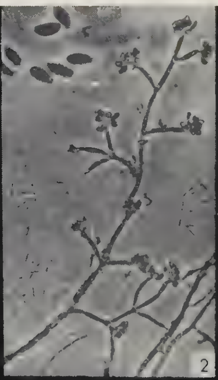
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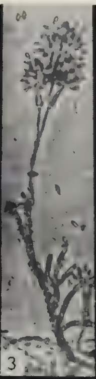
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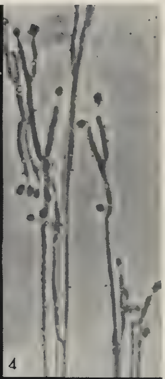
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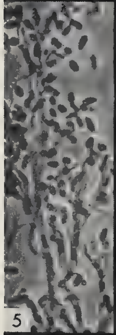
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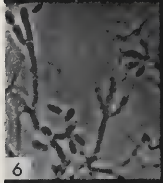
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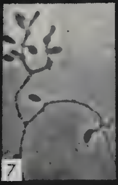
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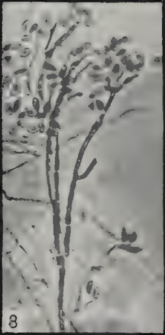
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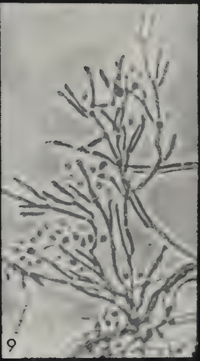
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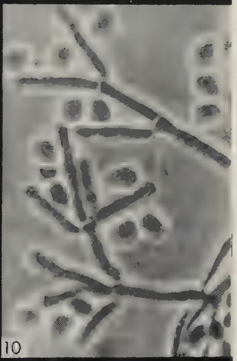
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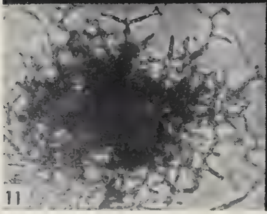
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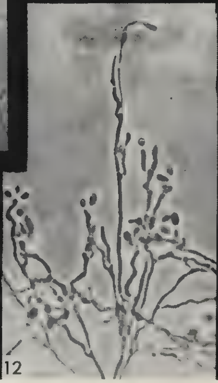
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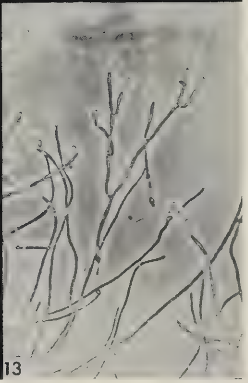
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Conidiophores and conidia (Fig. I: 5):—

These are similar to those of *N. nummularia* and *N. merrillii*, variable in length but usually long, 100—300 × 3·0—4·0μ, distinct from vegetative mycelium due to slightly darker colouration and fine wall pitting, branched to the second degree. Fertile branches arising 2—4 at a node, in single or compound verticils, swollen clavate but not as conspicuously stout as in allied species, 9·0—22 × 2·5—3·5μ. Conidia acrogenous, sessile, narrow clavate with blunt or rounded ends, white en masse, 2·3—3·4 × 3·4—5·7μ, ave. 2·8 × 4·8μ.

9. **Numulariola pithodes** (Berk. & Br.) Martin (Plate IV: 9)

Saccardo P. A. *Sylloge Fungorum* **1,** 298, (1882)
sub *Diatrype pithodes* Berk. & Broome
Berkeley M. J. & C. E. Broome Jour. Linn. Soc. **14,** 124, (1875)
sub *Hypoxylon pithodes* (Berk. & Br.) Miller
Miller J. H. World Species of *Hypoxylon* 113, (1961)
sub *Nummularia pithodes* (Berk. & Br.) Petch
Petch T. Ann. Roy. bot. gard. Perad. **4,** 436—437, (1910)
sub *Nummularia fusco-disca* Pat.
Patouillard N. Bull. Soc. Myc. de Fr. **31,** 35, (1915).

Stromata aplanate, flat, widely effused, 12—42 × 24—95 × 1·8—4·4 mm; ectostroma retained as a smooth matt external dull brown to black layer. Entostroma carbonaceous, usually rather well developed, dull brown to black, Perithecia immersed, close crowded, long ovate, 300—600 × 1200—2500μ; ostioles raised or medium papillate. Asci not seen. Spores gibbous to navicular, narrow ended, each bearing an obtuse broad or narrow hyaline appendage proximally, medium to dark brown, 10·0—17·5 × 19·5—37·5μ, ave. 12·0 × 24·3μ.

South African Hosts: Unidentified.

Material examined:—

Cunningham 3704; on *Podocarpus*, New Zealand, (1930), (Mill.). Martin 1012; Nature's Valley, Knysna District, Western Cape (1962).

Cultural characters:—

Colonies cottony, coarse, dull white to ochraceous with typical straggling surface. Margin not distinct, entire, pioneer hyphae widely dispersed. Conidia appearing by 7 days but not conspicuous. Stain ochraceous, diffuse. Growth rate moderate, 3·0 mm/day at 25°C.

These characters are similar to those of *N. mediterrana*.

Plate VIII. Conidiophores and conidia: *Daldinia.*

1—3. *Daldinia eschscholzii;* variation in conidiophores (× 210). Inset: Spores (× 540). 4. *Daldinia bakeri* (× 210). (Ignore oil droplets). 5—7. *Daldinia vernicosa;* variation from complex to simple conidiophores (× 210). 8, 9. *Daldinia concentrica* (× 210). 10. *Daldinia concentrica;* detail of fertile branches (× 540). 11. *Daldinia concentrica;* secondary mycelium (reticulate-tentacular) typical of genus (× 210). 12, 13. *Daldinia occidentale* (× 210).

Microscopic characters:—

Primary mycelium uniform, rather narrow, marginal hyphae up to 3·0μ in diameter. Secondary mycelium as for *N. uniapiculata*, colourless to light brown, loosely organized, 2·2—5·3μ diameter.

Conidiophores and conidia (Plate IX: 5—7):—

Conidiophores colourless, short, with smooth walls, atypical for the species group; 33—90 × 2·0—2·5μ. Main axes are distally branched ternately to the first or second degree; fertile branches often crowded, swollen clavate, in trident formation with unspecialized or slightly swollen heads; 4·3—6·8 × 2·2—3·7μ. Conidia acrogenous, sessile, narrow clavate, white en masse, 2·7—3·7 × 4·3—5·0μ, ave. 3·3 × 4·7μ.

10. **Numulariola atropunctata** (Schw. ex Fr.) House

House H. D. N.Y. State Mus. Bull. **266,** 49, (1925)
sub *Anthostoma atropunctata* (Schw.) Saccardo
Saccardo P. A. Sylloge Fungorum **1,** 295, (1882).
sub *Diatrype atropunctata* (Schw.) Berk.
Berkeley M. J. Trans. Linn. Soc. **22,** 269, (1858)
sub *Hypoxylon atropunctatum* (Schw. ex Fr.) Cke.
Cooke M. C. Grevillea **11,** 138, (1883). Ellis J. B. & B. M. Everhart Jour. Mycol. **4,** 89, (1887): N. Amer. Pyren. 650, (1892). Miller J. H. Mycologia **20,** 324, (1928); World Species of *Hypoxylon* 114, (1961). Owens C. E. Proc. Indiana Acad. Sci. **1911,** 300, (1912). Shear C. L. Lloydia **8,** 259, (1945).
sub *Nummularia atropunctata* von Hohnel
von Hohnel F. Ann. Mycol. **16,** 219, (1918). Lloyd C. G. Myc. Writ. **7,** 1352, (1925)
sub *Sphaeria atropunctata* Chw.
Fries E. M. Systema Mycol. 351, (1823). Schweinitz L. v. d. Synops Fung. Car. Sup. 31, (1822).

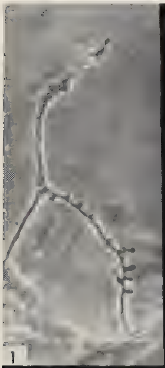
Stromata aplanate and widely effused with convex surface, 10—27 × 80—140 × 0·5—0·6 mm. Ectostroma persistent and well developed, smooth, white and corky, interrupted only by the black papillate ostioles. Entostroma carbonaceous, black, rarely exposed. Perithecia immersed, oval, 200—300 × 300—400μ; ostioles minutely papillate. Asci cylindric, 120—200 × 14—20μ; stipes 13—31μ. Spores oval elliptic, equilateral, dark brown, 9·5—17·0 × 18·0—34·5μ, ave. 12·7 × 27·1μ.

Material examined:—

A large quantity of material in the herbaria cited. Martin 625 ex Barnett & Stipes; Morgantown, West Va., U.S.A., (1961). Martin 1124, 1138, 1182; Lake Ozark, Mo., U.S.A., (1962).

PLATE IX. Conidiophores and conidia: *Numulariola*.

1. *Numulariola polysperma;* vesiculate mycelium (×210). 2. *Numulariola atropunctata* (×210). 3. The same: detail of (2) (×540). 4. *Numulariola exutans* (×210). 5, 6. *Numulariola* pithodes (×210). 7. The same: detail of (6) (×540). 8. *Numulariola punctulata* var. *obconica*. Simple conidiophore (×540). Inset: whole conidiophore (×210). 9, 10. *Numulariola comedens; Acrostaphylus* variants approaching *Basidiobotrys* (×210). 11. The same: detail (×540). Inset: Cylindric spores (×540).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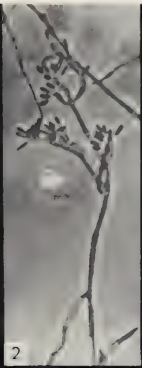
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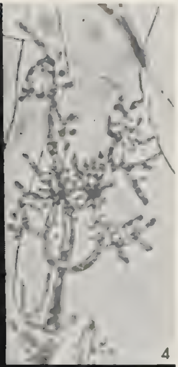
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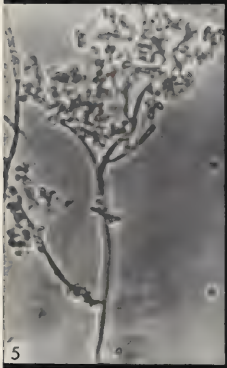
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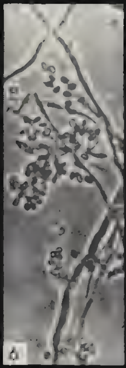
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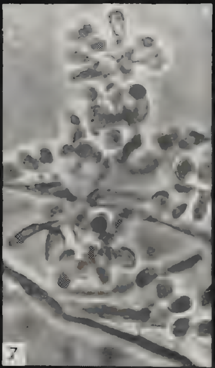
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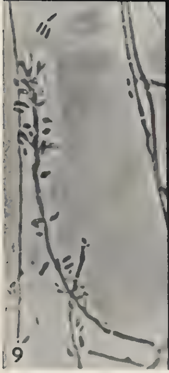
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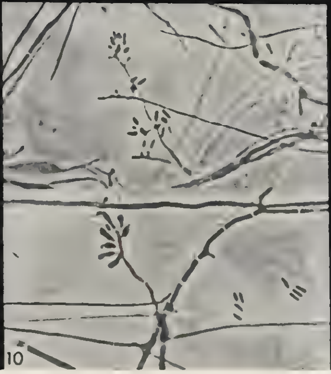
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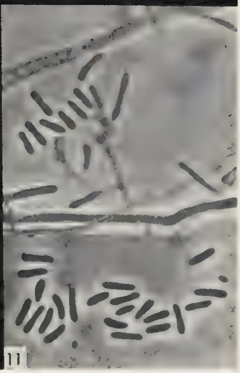
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Cultural characters:—

Colonies cottony, with the usual coarse texture, dull white. Margin entire, not distinct, hyphae widely dispersed. Conidia apparent by 7 days but not conspicuous. Stain greenish brown. Growth rate extremely rapid, 12·3 mm/day at 25°C.

Microscopic characters:—

Primary mycelium undiagnostic; marginal hyphae up to 3·1μ in diameter.

Conidiophores and conidia (Plate IX: 2, 3):—

Conidiophores less distinct than other species, with smooth walls, but tinted dull brown, 37—240 × 5·0—5·5μ, unbranched or branched dichotomously up to the second degree over their entire length. Fertile branches clavate, lying freely, heads unspecialized, 7·5—15 × 3·1—3·7μ. Conidia acrogenous, sessile or on stout sterigmata, oval or botuliform with truncate bases, white en masse, 2·5—3·1—4·2—7·3μ, ave. 2·6 × 4·8μ, ave 2·6 × 4·8μ.

11. **Numulariola mediterranea** (DN) Martin nov. comb. (Plate III: 5, 6)

sub *Diatrype clypeus* Berk.
    Berkeley M. J. Grevillea **4,** 95, (1876)
sub *Hypoxylon clypeus* Curt.
    Curtis Geol. & Nat. Hist. Survey NC III, 140, (1867). Ellis J. B. & B. M. Everhart N. Amer. Pyren. 627, (1892)
sub *Hypoxylon mediterraneum* (DN) Miller
    Miller J. H. Mycologia, **33,** 75, (1941); Bothalia, **4,** 254, (1942); World Species of *Hypoxylon* 116—118, (1961)
sub *Hypoxylon regium* DN
    De Notaris G. Hedwigia **2,** 169, (1863); Sferiacei Italici 15, (1863)
sub *Hypoxylon repandoides* Fuckel
    Bizzozero G. Flor. Veneta critt. **1,** 2101, (1885)
    Fuckel L. Symb. Myc. 236, (1869—1870)
sub *Hypoxylon sertatum* Dur. & Mont.
    Montagne J. F. C. Syll. Crypt. 214, (1856)
sub *Hypoxylon stigmateum* Cke.
    Cooke M. C. & J. B. Ellis Grevillea **7,** 4, (1878). Ellis J. B. & B. M. Everhart Jour. Mycol. **4,** 89, (1887); N. Amer. Pyren. 651, (1892)
sub *Nummularia clypeus* Cke.
    Cooke M. C. Grevillea **12,** 6, (1883). Miller J. H. Mycologia **20,** 323, (1928). Rehm H. Leafl. Philipp. Bot. **6,** 1943, (1913). Rick J. Brotéria ser. bot. **25,** 41, (1931). Shear C. L. Mycologia **33,** 321, (1941)
    Theissen F. Ann. Mycol **7,** 11, (1909)
sub *Nummularia regia* (DN) Sacc.
    Oliviera B. D. Rev. Agron. **19,** 16, (1931). Saccardo P. A. Syll. Fung. **1,** 400, (1882). Traverso J. B. Flora Ital. Crypt. **1,** 58, (1906)
sub *Nummularia repandoides* (Fckl.) Sacc.
    Lloyd C. G. Myc. Writ. **6,** 882, (1919). Rabenhorst G. L. Krypt. flor. Deutsch. II, 850, (1887). Saccardo P. A. Sylloge Fungorum **1,** 397, (1882)
    Sydow H. & F. Petrak Ann. Mycol. **20,** 186, (1922)
sub *Nummularia sertata* (Dur. & Mont.) Cke.
    Cooke M. C. Grevillea **11,** 126, (1883)
sub *Sphaeria clypeus* Schw.
    Schweinitz L. v. d. Syn. Fung. Car. Sup. 31. 31, (1822)

sub *Sphaeria mediterranea* DN
De Notaris G. Microm. Ital. Sec. **6**, 96, (1851)
sub *Sphaeria sertata* Dur. & Mont.
Durieu de Maisonneuve M. & J. F. C. Montagne Explor. Alger. I, 455, (1846)

Stomata usually widely effused, aplanate, with a flat or slightly convex matt surface, 7—144 × 15—300 × 0·6—2·2 mm. Ectostroma dull brown to grey, somewhat granulate, feebly persistent, usually merging with the entostroma beneath. Entostroma carbonaceous, dull brown to black. Perithecia immersed, close crowded and flattened due to pressure, oval, 200—600 × 400—1000μ; ostioles usually conspicuously conic papillate. Asci cylindric, short stipitate or nearly sessile, 105—140 × 8—11μ; stipes 7—38μ. Ascal plugs discoid to cylindric, sometimes rather attenuated and atypical for the group. Spores elliptic equilateral, gibbous or navicular, dark brown to black, characteristically a rich chestnut, 5·0—14·5 × 10·5—26·5μ, ave. 8·0 × 17·4μ.

South African Hosts: *Maytenus buxifolia*, *Olea capensis*, *Vepris lanceolata*.

Material examined:—

A large quantity of material in the herbaria cited. Martin 19, 31, 427; Nature's Valley, Knysna District, Western Cape, South Africa (1958, 1959). Martin 623 ex Barnett & Stipes; Morgantown, West Va., U.S.A., (1961). Martin 782, 783; O'Brien, N. Calif., U.S.A., (1961). Martin 1026, 1027. Fillmore, Calif., U.S.A., (1962). Martin 1058; Santa Paula Mtn., Calif., U.S.A., (1962). Martin 1108; Columbia Mo., U.S.A., (1962). Martin 1181, 1184, 1187; Lake Ozark, Mo., U.S.A., (1962). Martin 1618, 1619; Pine Meadow, Rockland Co., NY State, U.S.A., (1963). Martin 1831; Santa Anita Canyon, Los Angeles, Calif., U.S.A., (1963. Martin 1832—4; Gorman, Calif., U.S.A., (1963).

Cultural characters (Plate V: 5; Plate VI: 8; See also Martin (1967) p. 214 fig. 5)

Colonies at first appressed felty and subhyaline; later the aerial mycelium thickens to nearly 3 mm in height and becomes opaque, granulate, coarse, dull white to yellow or ochre, sometimes with olive green colouration around the site of inoculation. This species has the straggling appearance of other members of this group; in addition most of the American strains developed vertical tufts of hyphae seen elsewhere as in *N. tinctor*. Margin not distinct, effuse, entire but with widely separated long pioneer hyphae. Conidia produced by 7 days all over the colony surface, white, sometimes fairly conspicuous. Stain ochraceous to red brown or dull buff brown, sometimes initially a delicate pink. Growth rate rapid, 6·3—13·9 mm/day at 25°C. Growth on other media similar but less luxuriant on Czapek and with a more intense purple ochre hue.

Cultures of this species and *N. merrillii* are very similar when both well grown, and can only be distinguished by the following features:—

1. Plate cultures of *N. mediterranea* are white subhyaline when 2 days old, while those of *N. merrilli* are more opaque.
2. Czapek bottle cultures of *N. mediterranea* are distinguished by deep ochre yellow to brown mycelium and initial purple stain. Corresponding cultures of *N. merrillii* are not as strikingly coloured.

Microscopic characters (Fig. 1: 2, 10):—

The microscopic characters easily distinguish this species from its nearest relatives. Primary mycelium comprises stout hyphae with much narrower short curled side branches, and the diameter of the marginal hyphae extends to 6·6μ. The secondary mycelium is loose, ropy or reticulate, composed of light brown stout hyphae 1·8—9·7μ in diameter, larger on the whole than the corresponding ones in *N. merrilli*.

Conidiophores and conidia (Plate X: 3—6; See also Martin (1967) p. 230, fig. V: 4, 9 and 10):—

This species shows enormous variation in size, shape and construction of the conidiophores, ranging all the way from a simple *Sporothrix* type through *Acrostaphylus* to the extremely complex *Basidiobotrys*. The conidia may be produced in a group from the side of an ordinary unbranched and undifferentiated hypha (*Sporothrix* type I) in which case no conidiophore is strictly distinguishable, or from the apices of distinct fertile branches, often thumb-shaped, borne sporadically or from the distal parts of organized conidiophores. Only in the *Basidiobotrys* type is the wall of the conidiophores warted and tinted amber. The *Acrostaphylus* conidiophores are 16—630 × 1·8—3·7μ, branched up to the second degree; 2—4 fertile branches arising at a node. Fertile branches are narrow or swollen, clavate or elliptic, lying freely or in trident formation, 3·0—35 × 1·6—5·6μ. Conidia arise indiscriminately, in side-groups, or are acrogenous or pleuracrogenous, sessile or borne on sterigmata, thin-walled or thick-walled, botuliform, oval or clavate, white to fawn or dark brown en masse, 1·2—3·9 × 3·7—9·6μ, ave 2·5 × 5·5μ. South African strains had somewhat wider conidia than the American ones cultured.

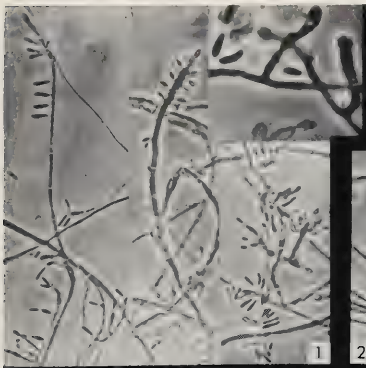
The *Basidiobotrys* type was observed in one strain only (1026), from America. The conidiophores comprises a stout axis 45—155 × 3·0—4·5μ with a spoon shaped apex bearing up to 52 clavate secondaries giving rise to the fertile branches by dichotomous or ternate branching, giving the overall impression of a bottle-brush. The fertile branches are themselves clavate, lying free or in trident formation, 6·2—10·6 × 3·1—3·7μ. Conidia are strictly acrogenous or pleuracrogenous, sessile, narrow clavate white en masse, 1·2—1·5 × 4·3—5·6μ, ave. 1·5—5·0μ.

Plate X. Conidiophores and conidia: *Numulariola* continued.

1—2. *Numulariola tinctor*. 1. Left and right: *Acrostaphylus conidiophores*. Centre: developing *Basidiobotrys* conidiophore (×210). Inset: detail of fertile branches (×540). 2. *Basidiobotrys conidiophores* (×210). At right, conidiophores in sympodial formation.

3—6. *Numulariola mediterranea*. 3. *Acrostaphylus condiophores* (×210). 4. Detail of *Acrostaphylus* (×540). Inset: The "thumb" type of fertile branch. 5. *Basidiobotrys* conidiophores (×210). 6. Detail of (5) (×540).

7—8. *Numulariola punctulata*. 7. *Basidiobotrys* conidiophores (×210). 8. Detail of 7 (bright field) (×540).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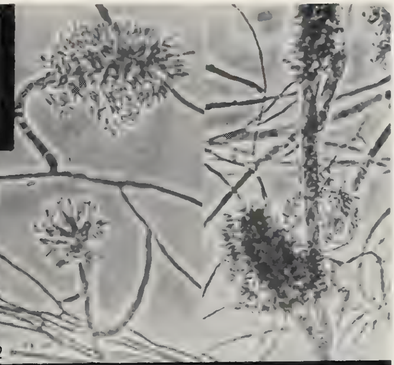
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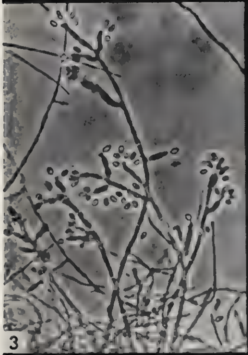
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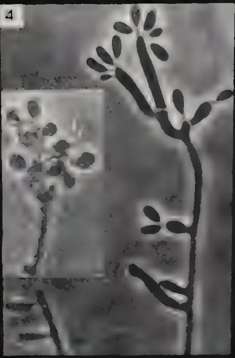
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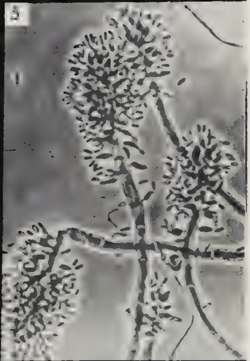
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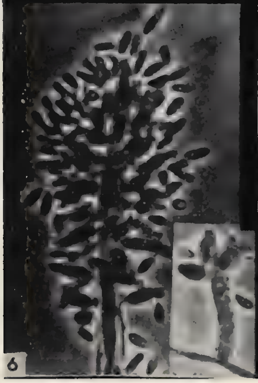
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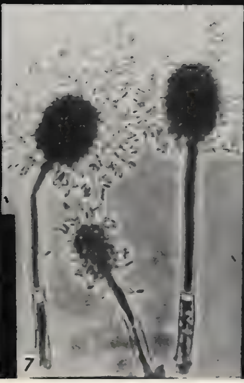
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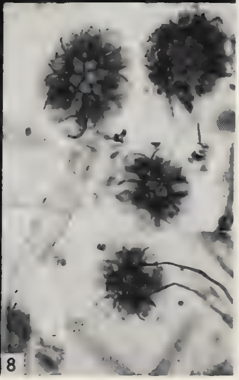
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12. **Numulariola punctulata** (Berk. & Rav.) Cke.

sub *Diatrype punctulata* Berk. & Rav.
Berkeley M. J. Grevillea **4**, 94, (1876)
sub *Hypoxylon punctulatum* (Berk. & Rav.) Cke.
Cooke M. C. Grevillea **11**, 138, (1883); Handbook of Australian Fungi 295, (1892). Miller J. H. World Species of *Hypoxylon* 109, (1961)
Winter H. G. & C. H. Demetrio Hedwigia 24, 195, (1885)
sub *Nummularia punctulata* (Berk. & Rav.) Sacc.
Chardon C. E. Mycologia **13**, 296, (1922). Ellis J. B. & B. M. Everhart Jour. Mycol. **4**, 90, (1887); N. Amer. Pyren. 627, (1892). Lloyd C. G. Myc. Writ. **7**, 1311, (1924). Miller J. H. Mycologia **20**, 325, (1928)
Rick J. Brotéria ser. bot. **25**, 44, (1931). Saccardo P. A. Syll. Fung. **1**, 399, (1882).

Stromata aplanate, widely effused, flat to convex, with a matt or glossy surface, 9·0—150 × 13—200 × 0·5—1·0 mm. Ectostroma dull brown when persistent at maturity; entostroma carbonaceous, dull brown to black. Perithecia close crowded, immersed, oval, 300—400 × 400—500μ: ostioles umbilicate, sometimes each one seated at the base of a depression. Asci cylindric, 75—125 × 6·9μ; stipes 10—51μ. Spores cylindric, oval or elliptic, equilateral, amber to colourless, hyaline 3·5—5·5 × 7·0—10·5μ, ave. 4·1 × 7·8μ.

Variety *obconica:* spores with proximal ends narrow. This character is not accompanied by other sufficiently distinguishing characters to make a separate species.

Material examined:—

A wide range of material in the herbaria cited. Martin 622 ex Barnett & Stipes; Morgantown, W. Va., U.S.A., (1961). Martin 639 ex Lowy; Baton Rouge, La., U.S.A., (1961). Martin 1620; Pine Meadow, Rockland Co., NY State, U.S.A., (1963).

Cultural characters :—

Colonies cottony to somewhat fleecy, coarse, with straggling surface and vertical tufts, ochraceous. Margin not distinct, entire; hyphae widely dispersed. Conidia apparent by 7 days but not conspicuous. Stain ochraceous to greenish brown. Growth rate moderate to fast, 3·6—7·1 mm/day.

Microscopic characters:—

Primary mycelium rather broad, marginal hyphae up to 12μ in diameter. Secondary mycelium loosely organized, light brown, 3·0—5·3μ in diameter. Imperfect Stage (Plate IX: 8; Plate X: 7, 8; See also Martin (1967) p. 230, fig. 8)

Barnett H. L. Mycologia **49**, 588—595, (1957).

Conidiophores belong to *Acrostaphylus* or *Basidiobotrys*; the latter type, as in *N. mediterranea* not universal. The *Acrostaphylus* type only belongs to variety *obconica* and is weakly differentiated, colourless, with smooth walls, 30—150 × 2·0—3·0μ, branched dichotomously or ternately to the first degree distally or at the ends of the main axes. Fertile branches are swollen, clavate to obovate, lying freely or in trident formation, 4·3—9·0 × 2·5—4·3μ. Conidia acrogenous, on slender sterigmata, narrow clavate, fawn brown, 2·5—3·8 × 3·7—5·6μ, ave. 3·0 × 4·8μ.

The *Basidiobotrys* type is more clearly differentiated, also smooth walled but tinted amber, 135—510 × 6·2—7·5μ, branched to the first degree only; main axes distinctly clavate with 33—80 fertile branches clustered at the ends in "bottle-brush" formation. Fertile branches swollen, elliptic rather than clavate, lying freely, 3·7—7·5 × 2·5—3·1μ. Conidia acrogenous, on slender sterigmata, long cylindric, ochraceous, 1·2—1·8 × 3·7—5·6μ, ave. 1·6 × 4·7μ.

13. **Numulariola tinctor** (Berk.) Martin nov. comb. (Plate IV: 1—3, 13)

sub *Diatrype tinctor* (Berk.) Sacc.
Saccardo P. A. Syll. Fung. **1**, 200, (1882)
sub *Hypoxylon tinctor* (Berk.) Cke.
Cooke M. C. Grevillea **11**, 133, (1883). Ellis J. B. & B. M. Everhart Jour. Mycol. **4**, 90, (1887). Lloyd C. G. Myc. Writ. **7**, 1311, (1924)
Miller J. H. World Species of *Hypoxylon* 118, (1961)
sub *Nummularia subapiculata* E. & E.
Ellis J. B. & B. M. Everhart Jour. Mycol. **5**, 22, (1890)
sub *Nummularia tinctor* (Berk.) Cke.
Cooke M. C. Grevillea **11**, 133, (1883). Ellis J. B. & B. M. Everhart Bull. Lab. Nat. Hist. Univ. Iowa **2**, 405, (1893). O'Neal C. E. Proc. Indiana Acad. Sci. **1914**, 240, (1914). Saccardo P. A. Ann. Mycol. **9**, 249, (1911).
sub *Sphaeria tinctor* Berk.
Berkeley M. J. Hooker's London Jour. of Bot. **4**, 311, (1845).

Stromata aplanate, usually widely effused, with a flat matt surface, 9·0—30 × 17—50 × 0·5—2·0 mm. Ectostroma usually retained at least partly at maturity, burgundy brown; entostroma carbonaceous, well developed, dark brown to black. Perithecia immersed, close crowded, elliptic, 300—400 700—1500μ, often several to one ostiole; ostioles umbilicate when entostroma is present, being immersed in it, papillate when entostroma has been sloughed off. Asci cylindric, 120—195 × 9—14μ; stipes 21—60μ. Ascal plugs discoid to cylindric, the latter splitting horizontally into proximal and distal halves; sometimes the proximal half is enclosed between coronet shaped projections. Spores elliptic, gibbous to navicular, broad or narrow rounded, amber, hyaline to subhyaline, 5·0—9·5 × 10·5—23·0μ, ave. 7·4 × 16·5μ. This species grows commonly on *Platanus occidentale* in North America.

Material examined:—

A wide range of material in the herbaria cited. Martin 589; Palmdale, California, U.S.A., (1961). Martin 1025; Fillmore, Calif., U.S.A., (1962). Martin 1030, 1031; Montezuma's Castle, Arizona, U.S.A., (1962). Martin 1056, 1057; Mill Creek, San Bernardino, Mtn., Calif., U.S.A., (1962). Martin 1092, 1093; Columbia, Mo., U.S.A., (1962). Martin 1140, 1161; Lake Ozark, Mo., U.S.A., (1962). Martin 1502, 1504, 1505, 1522, 1524, 1572; San Blàs, Nayarit, Mexico, (1962). Martin 1830; Gorman, Calif., U.S.A., (1963).

Cultural characters (See Martin (1967) p. 212, fig. 4):—

Colonies cottony, with the usual coarse straggling appearance, also with vertical tufts of hyphae, dull white to ochre. Mycelial aggregates sometimes present in slight quantity. Margin not distinct, entire; hyphae widely dispersed. Conidia appear early or late but are not conspicuous. Stain amber to dull buff brown, not conspicuous, as in *N. uniapiculata*. Growth rate rapid, 4·9—8·6 mm/day at 25°C.

Microscopic characters:—

Primary mycelium undiagnostic; marginal hyphae up to 3·7μ in diameter. Secondary mycelium uniform, loosely organized, 3·0—10·5μ in diameter.

Conidiophores and conidia (Plate X: 1, 2; See also Martin (1967) p. 230, figs. 5—7)

The great majority of strains studied showed both the *Acrostaphylus* and *Basidiobotrys* types of conidiophore which were clearly distinct from the vegetative mycelium due to amber or dark brown tint and warted walls. The conidiophores were uniformly narrow or broad clavate apices, and were unbranched or branched dichotomously to the second degree, branched all over, distally or strictly apically in "bottle-brush" formation, 85—410 × 3·7—6·0μ. Fertile branches swollen, clavate or elliptic, lying freely, 50—108 per head, 5·0—11 × 2·5—4·3μ. Conidia acrogenous, sessile or on slender sterigmata, pyriform, white to yellow en masse, 1·2—2·5 × 5·6—10·0μ, ave. 2·0—7·1μ.

14. **Numulariola comedens** (Ces.) Martin nov. comb.

sub *Hypoxylon comedens* (Ces.) Cke.
Cooke M. C. Grevillea **11**, 126, 1883. Miller J. H. World Species of *Hypoxylon* 107, (1961)
sub *Nummularia comedens* Cesati
Cesati V. Atti R. Accad. Scienze Fisich e Matem. **8**, 19, (1879).

Stromata aplanate; usually fairly large but sometimes restricted, with a flat or concave smooth, dull or shiny surface, 4·0—17 × 5·5—55 × 1·2—1·5 mm. Ectostroma absent at maturity; entostroma black carbonaceous, well developed. Perithecia at centre of stroma, surrounded by large sterile margin, immersed, oval-elliptic, close-crowded, 1—10 per ostiole, 200—600 × 100—1200μ; Ostioles either not visible or unbilicate with raised rims. Asci cylindric, 100—180 × 6—11μ; stipes 30—56μ. Spores elliptic, equilateral or gibbous, broad or narrow rounded, amber, subhyaline to translucent, 5·0—9·0 × 10·5—23·0μ, ave. 6·4 × 15·5μ. This species is close to *N. tinctor*, differing in extent of sterile stroma, many perithecia converging towards 1 ostiole, and in the spore characters. It is doubtfully separable from *N. cyclisca*.

Material examined:—

Martin 932, 933, 938; Mazatlàn, Sinaloa, Mexico, (1961).

Cultural characters:—

Colonies cottony with the usual coarse straggling surface, also with vertical tufts, dull white to ochre. Mycelial aggregates absent. Margin not distinct, entire, hyphae widely dispersed. Conidia only develop when old. Stain dull buff brown to olive green, more conspicuous than in *N. tinctor*. Growth rate rapid, 4·0 mm/day.

Microscopic characters:—

Primary mycelium undiagnostic; marginal hyphae broad, up to 5·0μ in diameter. Secondary mycelium absent: a feature unusual in this species group.

Conidiophores and conidia (Plate IX: 9—11):—

This species has so far shown the *Acrostaphylus* type of conidiophore and some intermediate with *Basidiobotrys*. The conidiophores resemble those of *N. tinctor*, and are colourless, with smooth or warted walls, 35—120 × 1·2—2·5μ, branched dichotomously to the first or second degree distally or at the apices of the main axes. Fertile branches relatively few to several loosely aggregated per head, narrow or swollen elliptic, lying free, with unspecialized apices, 4·3—22·5 × 1·5—3·1μ.

Conidia acrogenous or in side-groups off the hyphae, sessile, narrow clavate, white en masse, 1·2—2·5 × 5·0—7·5μ, ave. 2·2 × 5·9μ.

ACKNOWLEDGEMENTS

The writer wishes to thank, in addition to those cited by Martin (1967), Mr. Max Ulrich of the Photography Dept., S.A.I.M.R., in preparing the illustrations.

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